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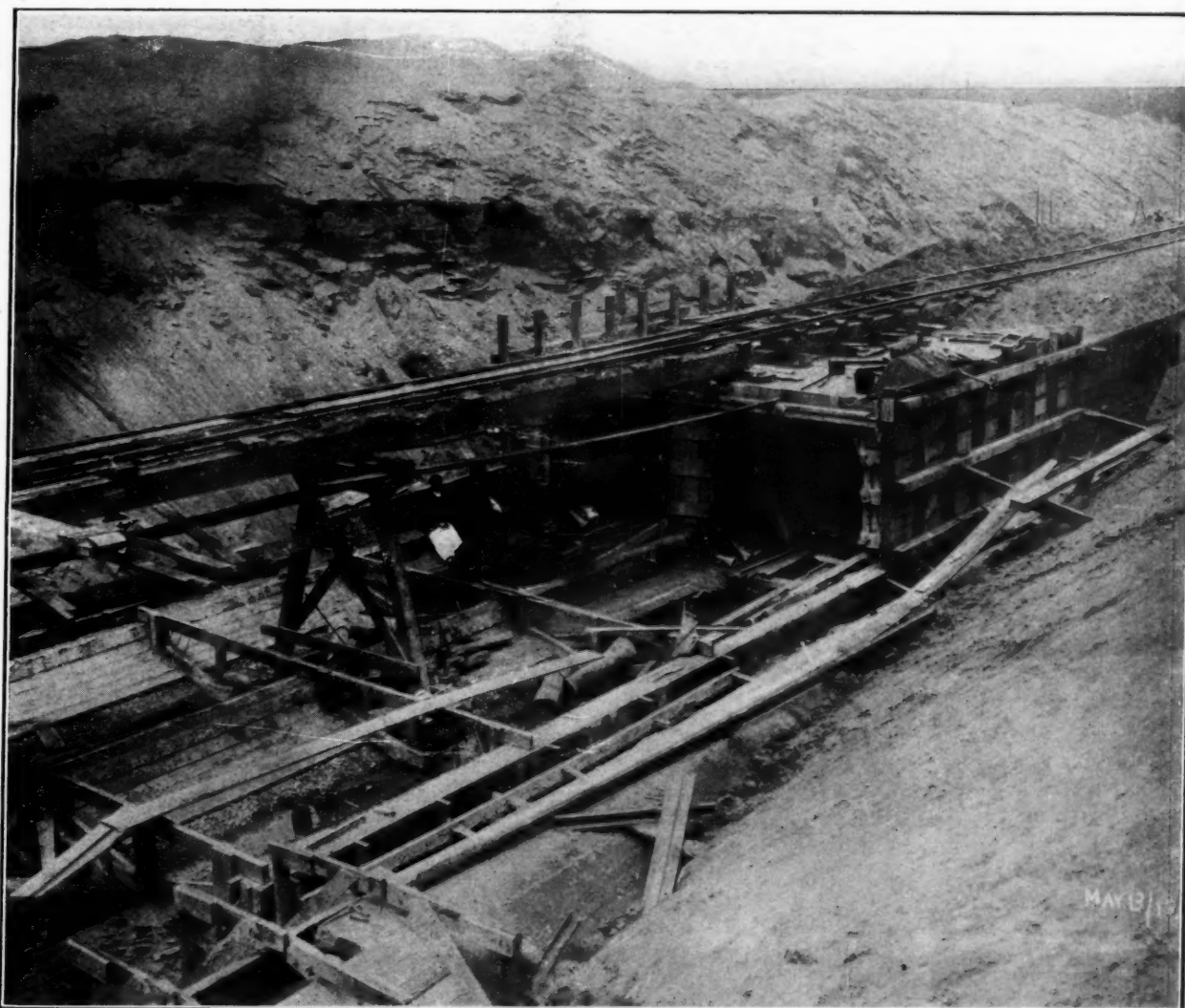
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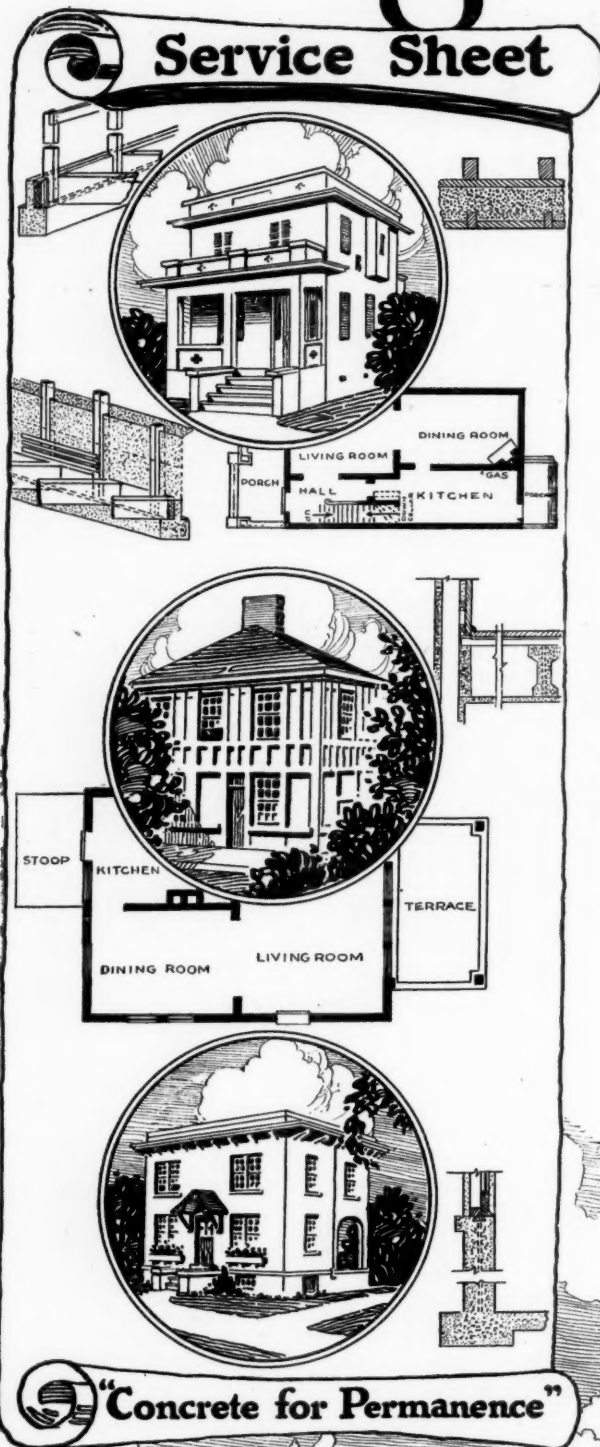
CONSTRUCTING RALPH AVENUE SEWER, BROOKLYN

Forms in position for invert in foreground, completed twin 168-inch sewers in background; construction track on top.

Will be described in next week's issue.

NOVEMBER 27, 1920

Valuable Information on Workingmen's Homes



Several years ago the increasing interest in small houses of permanent, fireproof type prompted us to prepare a Service Sheet on a type of employes' house that we had built at two of our own plants.

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We have a small reserve stock of these practical Service Sheets and will gladly send copies to any manufacturer, engineer, architect, contractor, builder, chamber of commerce or property-owner interested.

Copy of the 96-page ALPHA Handbook will also be sent free of obligation. No charge if you live East of the Mississippi River. We feel obliged to ask those living out of our sales territory to send fifty cents to cover cost of printing and mailing this literature.

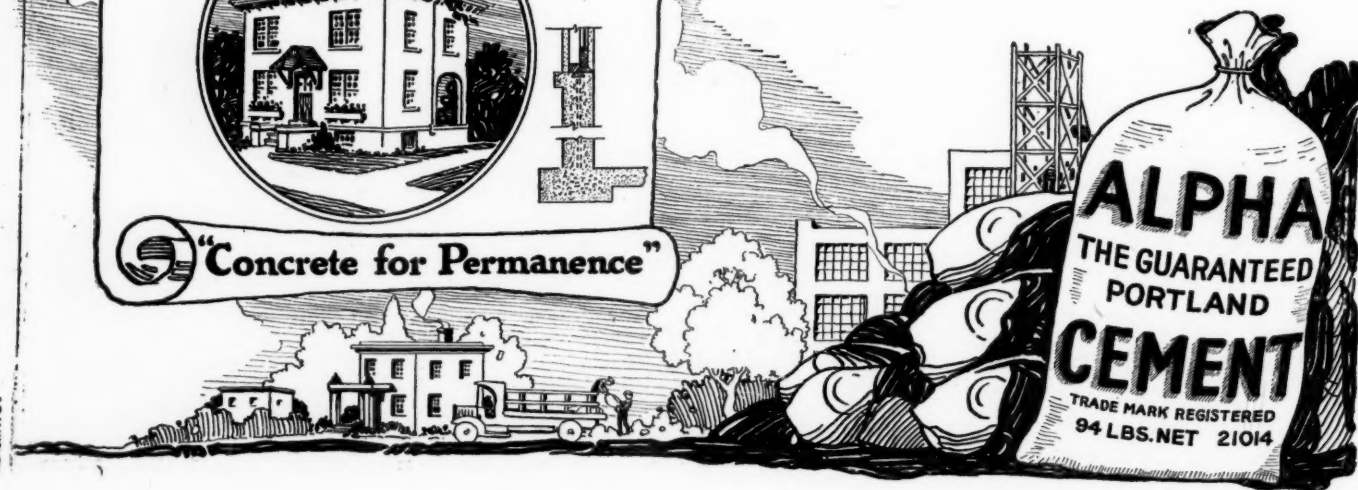
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A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 49

FLORAL PARK, NOVEMBER 27, 1920

No. 22

Constructing a State Road in North Carolina

By W. A. Hardenbergh

Removing seven hundred cubic yards of light grading a day by steam shovel. Mixer on caterpillar traction and trucks with pneumatic tires used on red clay sub-grade. More than six hundred lineal feet of pavement laid a day. Dirt shoulders for horse-drawn traffic.

Just south of High Point, N. C., is being constructed an asphalt-topped concrete road 12,000 feet long at a cost of about \$80,000. There are several features of interest in the work, among them being the speed attained in grading and in concreting. About fifty men, almost all colored, are employed, but labor-saving devices are numerous. Included in the equipment are a steam shovel, a crane, a roller, a scraper, a concrete paving mixer, and six motor trucks.

The strip of road being improved is a section of the Southern National Highway, and carries a great deal of motor traffic, both local and through, as well as considerable local horse-drawn traffic. None of the grades on the old road (which was of bituminous macadam) was severe enough to retard the progress of the average motor vehicle, but in accordance with the policy of the State Highway Department, even these are being cut down so as to eliminate nearly all the rise and fall.

An Erie steam shovel has been used for grading, except where this has been so shallow as to make its use unprofitable. The heaviest cut has been about 42 inches; the lightest on which the shovel has been used, about 8 inches. On the entire job, the shovel has cut very closely to grade, thus reducing the amount of hand grading necessary. Also very good speed has been attained at times. In a cut averaging from 36 to 42 inches, it was stated, the shovel moved 700 cubic yards in one day, wasting earth alongside the road in addition to keeping seven teams busy. An ordinary road scraper is also used in shallow grading.

The new road is of concrete base, with an asphalt top coat two inches thick. The width between curbs is 15 feet; the curbs are two inches higher than the concrete base (to make them flush with the surface of the asphalt) and twelve inches wide each. This gives the road a total width of 17 feet. To care for the not inconsiderable horse traffic, shoulders 6½ feet wide will be constructed

on either side of the pavement. The concrete base is 5 inches thick throughout the entire section, the subgrade being arched to correspond to the road surface. The concrete is being mixed 1:3:6, except that the curbs, above the base, are of 1:2:3 concrete. The wearing surface is to be a stone-filled asphalt two inches in thickness.

As stated, most of the grading and excavation has been done with an Erie shovel. The earth not needed for making new fills or widening old ones is wasted along the right-of-way. This will be used later in constructing the shoulders, but that work will be done by the local authorities. On account of the added width of the new road, culverts will have to be lengthened and bridges widened. This work also will be done by the local authorities.

The soil in this section is a very dense, tight, red clay, which packs very well when damp, becomes a bottomless morass when wet, and turns into a red cloud of dust in dry weather. It does not take up any water from the concrete. When slightly dampened it compacts well under the roller, and shapes up to grade easily. In wet weather, work has to be suspended.

The fine-grading gang averages about ten men. They are followed by a Kelly roller. On some of the work the road scraper has been used just ahead of the roller to give the subgrade its final shape.

Water is taken from the High Point municipal system and is carried through a line of 2-inch pipe. Wooden forms are used, and these are held in place with wooden stakes.

A Foote paving mixer with caterpillar traction is used. This handled very well under the difficult soil conditions of the job. Batches of sand, stone and cement, already properly proportioned, are brought by motor trucks and mule carts from the stock piles, and dumped into the mixer scoop. This does away with the trouble and waste of stock piles

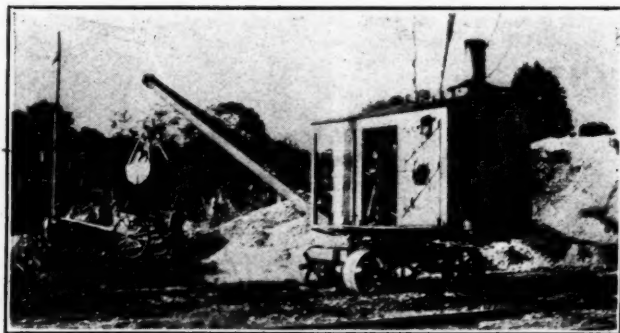
on or along the right-of-way, and has proved very efficient. The daily average of 17-foot pavement laid has been just above 600 feet, though this amount has been exceeded at times. Only thirteen men are ordinarily employed at the mixer—15 men occasionally. Two men help dump the trucks and carts with the batches of sand, stone, and cement ready for mixing. In addition there are: One engineer, one fireman, one foreman, two finishers, one curb-man, and five men on the spout and spreading the concrete. Behind the mixer, on the wet concrete, is towed a platform about 6 feet wide and 8 feet long, on which is mixed by hand the concrete for making the curbs.

A rather wet mix is being used. Since an asphalt wearing surface is to be added, no finish is given to the concrete. No expansion joints are being used. The new concrete is protected, as it sets, by a thin dirt covering.

Local sand is used. This was hauled from time to time to the contractor's stock-yard in the edge of the city, and there piled by means of an Erie Crane, Type B, with a $\frac{3}{4}$ -yard clamshell bucket. Stone is shipped in by rail from the contractor's quarry in another part of the state, and is unloaded by the crane and piled. This same crane also charges the trucks and carts with sand and stone. A crane-man and a fireman have unloaded a car in 35 minutes. Throughout the day, an average of a car an hour has been unloaded, the crane at the same time charging the trucks and carts.

The contractor, H. G. Lassiter & Co. of Greensboro, N. C., is using six Ford trucks equipped with pneumatic tires, and from six to ten (at present seven) one-mule carts for hauling the already proportioned batches from the stock-yard to the mixer, the number used depending upon the length of haul. The carts are the ordinary one-mule cart found so commonly throughout the south. They are equipped with side and end boards, and so pivoted that when loaded, the weight is nearly balanced. Two men can easily dump them into the charging scoop, which is equipped with a stop-block to secure the proper position of the cart when dumping.

The Ford trucks are equipped with 4-inch Royal Cord (U. S.) pneumatic tires, and the body construction and arrangement is essentially the same as in the carts. The driver does nothing but drive; the two men at the mixer dump the truck; the crane at the stock-piles loads it. The work is well organized, and it is rare to see a waiting line of



ERIE CRANE LOADING MULE CART WITH AGGREGATE trucks and carts, or to have the mixer stop for lack of materials.

As has been mentioned, the soil, when at all wet, cuts up very easily. The pneumatic tires tend to pack down the already rolled subgrade in front of the mixer, where solid tires would cut it up. The use of pneumatics also reduces the number of cars stuck in soft places—almost eliminates this trouble.

The crane is placed between two large piles, one of stone, the other of sand. When a cart or truck drives up, the clamshell delivers stone, then sand, cement is added nearby, by hand.

Both 2-bag and 3-bag batches have been used, though at the time the writer visited the job, a two-bag batch was being used. It is hard to see just how the crane operator is able to judge very closely the amount of sand and stone per batch. For a three-bag batch, he delivers nearly a bucket of stone, and about half as much sand. For a two-bag batch, it is much more difficult, since only about 2-3 of a bucket of stone and 1-3 of a bucket of sand are required.

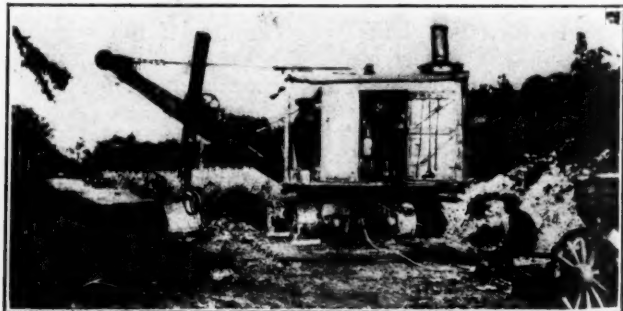
The asphalt top is to be mixed in an F. D. Cumber plant now being set up. A concrete tank to hold three carloads of asphaltic cement (Texaco) has been constructed, and it is expected that "hot stuff" will be turned out in the near future. This will be handled by the same trucks now used for concrete aggregate.

Highway "Lighthouses"

Local papers state that the entire state highway system of Wyoming is soon to be equipped with highway "lighthouses," dangerous curves being designated by yellow lights and railroad crossings by red lights. The lighthouses will "wink" 45 times a minute, throwing a 9-inch ray which can be seen for a distance of three miles.

Delivering Concrete Road Materials

A 7-mile concrete road with 2 miles of 8 per cent grades near Binghamton, N. Y., is being constructed by the Rossoff Engineering Company. Sand and stone are delivered in trucks over the pavement after it is 14 days old; they are dumped on the pavement and reloaded into batch boxes carried over sub-grade by an industrial railroad an average distance of $1\frac{1}{4}$ miles to the mixing machine, which is of 3-bag capacity and has made a record of 450 feet in one day.



ERIE STEAM SHOVEL IN SHALLOW CUT

The aggregate is hauled an average of $3\frac{1}{2}$ miles by the trucks and on account of the heavy grades only 18 cubic feet are loaded into a 28-foot batch box.

The aggregate is handled by five 10-ton trucks and by 40 Western steel batch boxes and 20 Western road-builders' trucks operating over 6,500 feet of industrial track, and hauled by a Whitcomb 6-ton gasoline locomotive and a Porter 6-ton steam locomotive. Water is pumped 2 miles through a 2-inch pipe and a 75-foot lift with a $2\frac{1}{2}$ -h. p. engine and then lifted 800 feet more from the road to the mixer by a 6-h. p. booster pump. The mixer gang consists of 8 men and the water boy, besides a man at the finishing machine and the superintendent.

Repairing Wood Pavement With Jackscrews

Wood block pavements in St. Louis that had become loose by the shrinkage of the wood were repaired by cutting in the pavement transverse slots and in each slot laying a pair of 4x6-inch horizontal timbers separated by jackscrews. When the jackscrews were operated in dry, warm weather they pushed the blocks over the softened filler for a maximum distance of 125 feet, and when the pressure was maintained, closed the joints and greatly improved the pavement. No permanent compression was caused, and the blocks showed no tendency to creep back when the jackscrews were removed.

Laying Two-Course Concrete Pavement at One Operation

A 14-mile concrete road 16 feet wide near Charleston, Mo., has a 1:3:5 bottom course with a 2-inch top course of 1:2:3 concrete. The work is being executed by Roy Williams, contractor, who has installed a Koehring No. 21 paver, an Osgood shovel, a Lakewood finisher, 50 Western trucks, 100 Western batch boxes of 32 cubic feet capacity, three 4-ton Whitcomb locomotives, 4 miles of industrial tracks and 3 elevated storage bins.

A large supply of sand and gravel is maintained in storage piles on the ground opposite the bins, which are kept full by the crane that unloads the aggregates and reclaims it from the storage pile to the bins at a small extra cost for rehandling. A train of trucks, each carrying two batch boxes, is loaded by gravity from the bins, where every fourth car is marked to receive 5 bags of cement per batch box when the cars are hauled opposite the platform of the storage cement house, while the other cars receive 3 bags per batch box. At the site, three 6-bag batches are mixed and spread; then two 4-bag batches of the richer material for the top course are mixed and spread, finishing the concreting of that section without delay and insuring perfect bond between the upper and lower courses. At the mixer there are 10 men and a foreman, against a total of 27 men and foreman when the work is done with wheelbarrows. The

use of a 4-bag or larger machine instead of a 3-bag machine required for the base course enables the contractor to build an 18-foot pavement as rapidly as a 16-foot pavement with the smaller machine.

The use of industrial tracks, instead of the 15 trucks that it is estimated would be required to haul the material, saves the services of 9 men. The three locomotives employed consume about 60 gallons of gasoline per day in comparison with 240 gallons that would be required for the 15 equivalent trucks.

Kansas City-New Orleans Highway Planned

A 700-mile highway, an approximately air-line route from Kansas City to New Orleans, has been planned and the project is in charge of the Burham Engineering Company, Glenwood, Ark.

This road is intended to shorten the distance of travel between the entire upper Missouri valley region, and the principal gulf port and to intersect in its course five interstate and transcontinental highways, namely: The Santa Fe Trail at Kansas City; the Ozark Trail at Joplin; the Albert Pike Highway at Ft. Smith; the Scenic route of the Bankhead Highway at Glenwood, from which point Hot Springs, eastward, and Texarkana, the outlet to Texas and points west, are served.

According to state highway experts and Federal students of interstate travel, the Kansas City-New Orleans highway is one of the most strategic pieces of road work projected since the good roads movement began in Arkansas.

The route through Arkansas will open up one of the richest mineral regions in the state, and develop vast areas of rich lands now idle by reason of lack of transportation facilities.

It is stated that 600 miles of the total length of the highway has already been built and will be available when connected up to the intermediate portions and modified if necessary to conform to the standard requirements. As proposed, the highway passes through Joplin, Portsmouth, Glenwood, Monroe, Alexandria and Baton Rouge.

Value of Good Roads For Automobiles

It is estimated that in Iowa there are now about 430,000 automobiles and automobile trucks that have an average mileage of 5,000 for their tires and the present mileage could be increased to 12,000 if the roads were well paved so that with tires at \$20 each, there would be a saving of more than \$17,000,000 per year on tires alone. One-third of the present amount of gasoline would be saved on good roads and assuming this to be only one-third of a gallon a day for each automobile, it would amount to \$10,000,000 per year. The saving on repairs and upkeep of cars would reach nearly \$7,000,000 more, which, with the additional sum derived from the auto tax, is sufficient to build three roads across the full width of the state at a cost of \$40,000 per mile.

Virginia Road Construction

In order to expedite the completion of the entire 6,800 miles of road in the state system of Virginia, George Coleman, state highway commissioner, and Dr. S. M. Dollman, general director of the State Highway Association, have been making a campaign through southwest Virginia in the interest of the Constitutional State Amendment that will grant to the general assembly and governor authority to issue bonds and enable them to thus raise \$40,000,000 to complete the road construction program, which, on the pay-as-you-go plan, will require eighteen years. By the bond method, the result will be accomplished in six years and without additional taxes, by increasing the tax on motor vehicles twenty cents per h. p.; thus enabling the bonds to be retired in nineteen years.

It is considered essential to complete as early as possible the Virginia section of the state highway from Washington to Winchester and down the valley of Virginia to Roanoke and Bristol, thus forming a backbone road for 41 of the 99 counties of the state. This line is a part of the direct New York to New Orleans route and contains in its zone about one-half of the area of the state. The route is already completed from New York to Washington and passes through a section that is very attractive to tourists.

Record Highway Construction

The Pennsylvania Highway Department announces that during the week ending Thursday, October 14, all Pennsylvania records on road construction were broken by the construction, on various projects in that state, of 26.27 miles of highway.

During the present construction season and up until October 19, the State Highway Department of Pennsylvania has constructed approximately 320 miles of modern type roadway, and its maintenance forces have entirely resurfaced approximately 315 miles of macadam roadway and have oiled approximately 1,300 miles of road.

Highway Detours

Citizens of Rhode Island in the vicinity of Newport have registered complaint with the State Board of Public Roads against the manner in which a section of road in Tiverton is being reconstructed, the complaint being that the entire length and width of the road was torn up at once and no serviceable detour furnished except one through private land for which the owner charges a toll of 10 cents for each vehicle. As similar complaints are being raised in a great many states where road construction is under way, the reply of the board is interesting.

In general, it stated that the road carries less than 10 per cent as much travel as some other sections of the state road and yet the cost must be nearly as high, and that consequently it does not feel warranted in spending any more money on the construction than is absolutely necessary.

The contractor took the work for more than \$5,000 under the engineer's estimate and the board did not think it fair to insist that the cost of the work to the contractor be increased by insisting that he do the work in short sections. The board maintains that, while conditions for traveling along this road are uncomfortable, they are not impossible or dangerous and not a single report of an accident at these points has reached it.

As to the matter of the private detour for which a toll is charged, it stated that this was arranged at the express wish of representative citizens of the neighboring town, who informed the board that they would gladly pay a toll for the use of the private road and asking the board to fill in the gutters at each end of the detour onto the private land so that it could be used. The detour which is available for passing around the road under construction is in poor condition, but it is not a state highway but is under the supervision of the town of Tiverton.

In this connection, as in others, complaining citizens generally neglect to reflect that avoidance of the conditions against which they complain would frequently involve additional expense, which must come out of the taxes or in some other way from the pockets of the public generally. As the board in this case points out, to have provided in the contract that the road be built in short sections would have undoubtedly increased the cost of the work; a detour was available and if this was not in good condition the blame did not lie with the board; and the comparatively light travel on the road did not seem to warrant the charging of the state with as great expenditures during construction as might be advisable in the case of more heavily traveled thoroughfares.

In any case, to furnish a detour which would be thoroughly satisfactory to the travel on a given road which is under reconstruction would mean that, when the road itself has been reconstructed or repaired, there will then exist two routes suitable for the travel which could presumably be carried by one, which would not be ultimate economy.

Highway Bridges in New Jersey

One of the members of the New Jersey State Highway Board, David Young, has recently resigned, giving as one of his reasons that he does not wish to be held responsible for the collapse of any of the bridges of the state, for the reinforcement of which there is apparently no present provision. In his letter of resignation he states that the bridge engineer estimates that it will require \$18,000,000 to reconstruct and repair the highway bridges of the state so as to make them safe. He estimates that it will require \$76,000,000 to complete a highway and bridge program which will satisfy the citizens of the state and that no such amount is available, the other \$58,000,000 being for the construction of state highways not yet under contract.

On the other hand, he does not believe that any general manager of a private corporation would advise new construction of such magnitude at present prices, but that such a manager would recommend completing contracts now under construction or signed and for which money has been appropriated, but would stop at once the building of any other new roads; would arrange at once for the reconstruction of unsafe bridges, and organize a maintenance department that would adequately maintain the roads in a safe and comfortable condition until prices became normal. He believes that by holding off for normal times and prices to return, the road construction work could be done for about one-third of present costs.

Old Stone Sewer Collapses

By Edward S. Rankin*

Timber bottom of sewer fifty-seven years old rotted away and part of side wall collapsed. Method of repairing described.

The accompanying photographs show the results of a break which occurred recently in one of the old Newark, N. J., sewers, known as the Mill Brook sewer. In the early days Mill brook was an open stream, fed by springs and ran through a narrow valley into the Passaic river. In 1863 part of the brook was enclosed in a stone arch of about 10-foot span and varying from 6 to 12 feet in height. The natural bed of the brook formed the bottom of the sewer, as it had now become. About 25 years later a timber floor was laid and this has lasted, with a few repairs, ever since. After arching over the brook, the valley was filled to the surrounding level, a depth of about 18 feet, and in some places buildings have been erected directly over the sewer.

Early in November, 1920, a small hole about 2 feet in diameter was discovered in the surface of the ground, at the side line of a street crossing the sewer at right angles. Investigation showed that the earth below had caved in and just below the surface the hole was some 12 feet in diameter, partly beneath a one-story brick building. Figure 1 shows the hole after breaking down the surface and shoring up the building.

It was found on investigation that part of the timber flooring of the sewer had washed out and some of the stone near the bottom had been carried down the sewer, leaving an opening through which the earth above had been gradually undermined and carried away. The break occurred close to the point where the old stone arch joins a 9-foot circular brick sewer built in 1873.

*Engineer in charge, Bureau of Sewers, Newark, N. J.



FIG. 1—BUILDING SHORED UP OVER CAVED-IN SEWER

Figure 2 shows the junction of the stone and brick sewers, with a flume in place to carry the water while repairs were being made. The hole in the stone-work is not visible, being below the surface of the water on the right and just beyond the end of the flume.

In making the repairs, two sand-bag dams, braced with timbers, were built, one above and one below the break, and the flow was carried across through the timber flume shown in the photograph. The water between these dams was then removed with a hand pump.

Where the timber floor was washed out, a new bottom was formed of concrete placed in bags closely packed together. The break in the side wall was repaired with brick masonry.

An inspection has been made of this entire section and other breaks discovered farther up the sewer. These will be repaired in the same way. The arch is in good condition throughout.

The difficult part of the work is building the dams owing to the large volume of flow and the steep grade of the sewer. The sewer takes the combined flow from 1,740 acres, including the overflow from a large park lake. Should a storm occur while the dams are in place they would doubtless be carried away.

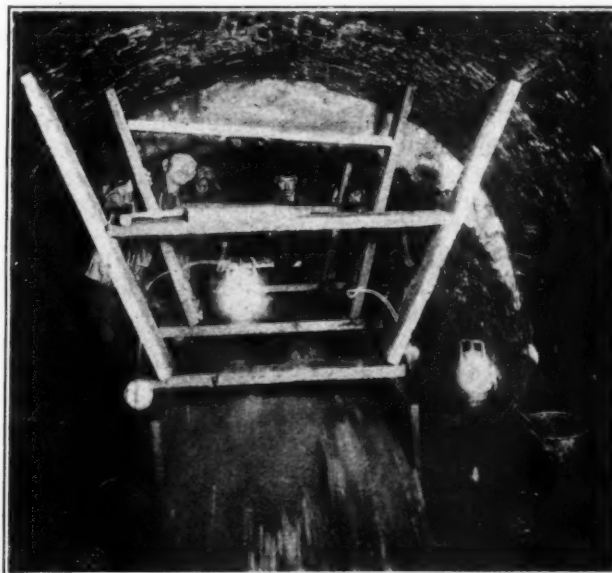


FIG. 2—VIEW OF INTERIOR OF SEWER AT JUNCTION OF STONE AND BRICK ARCH

The Disposal of Trade Wastes

By Robert Spurr Weston*

In a paper before the American Society for Municipal Improvements, the author summarizes quite fully the present status of this subject from the viewpoint of the municipal official, illustrating special features by examples of recent practice.

It is not the purpose of the writer of this short paper to cover the whole field of the disposal of trade wastes, voluminous treatises on which have been written by such writers as Schiele, Wilson, Naylor and others. There are certain features of the subject, however, which are of particular interest to municipalities. These are the treatment of wastes which must be received into city sewers and disposed of by dilution or in disposal works after mixture with domestic sewage, all of which are apt to produce nuisances when disposed of within municipal limits.

CHARACTERISTICS OF TRADE WASTES

Trade wastes differ greatly from sewages in their character and composition. Thus the sewage from the Center avenue sewer at Chicago, receiving the stockyard and Packingtown wastes, contains ten times as much total nitrogen, four times as much suspended solids, six times as much oxygen consumed, and nine times as much fats as the rather weak combined sewage from the Thirty-ninth street sewers. Again, the sewages from Massachusetts and English industrial cities are totally different from those from residential cities in the same regions. The trade wastes are usually much more concentrated, yet ordinarily of smaller volume than sewages. Consequently their importance increases with the dominance of the industry producing them in each particular locality.

Trade wastes are important factors in the design and operation of sewage works because they may contain:

1. Excessive amounts of suspended matter.
2. Suspended matter which may clog sewers.
3. Excessive amounts of fats and other organic matter.
4. Waste mineral oil.
5. Free acid.
6. Chemicals which inhibit the purifying action of bacterial beds.
7. Starchy or saccharine bodies which ferment with the production of butyric acid and other offensive compounds, and furthermore produce lactic and other acids which inhibit the action of the nitrifying bacteria.

It seems best in this paper to cite examples of the various classes of waste, although it must be borne in mind that the members of each class may differ almost as much in degree, if not in kind, as the classes among themselves.

*Of Weston & Sampson, Consulting Engineers, Boston, Mass.

(1) EXCESSIVE SUSPENDED MATTER

In Peabody, Mass., not many years ago, waste from rapidly growing tanneries, glue factories and similar industries were discharged into the North river and its tidal estuary between the cities of Salem and Beverly. At that time the stream conditions became unbearable. Sometimes the odor from the foul, dark-colored stream could be detected in Salem's best residential section, several blocks away; while at all times abundant bubbles of the gases of decomposition were generated in the putrefying deposits of sludge and rose to the surface of the stream. Conditions were by no means improved when a half-tide dam was constructed by the electric light company to insure a water supply for its condenser at all stages of the tide.

The condition in the stream was remedied by the construction by the cities of Peabody and Salem jointly of an intercepting sewer discharging into a pump well, from which the sewage was pumped through an outfall into deep tidal water. The various plants which had formerly discharged into the river were connected with the intercepting sewer. For a time all went well; but soon deposits accumulated in the sewer, particularly because pumping was often interrupted, and the velocity in the sewer was reduced to almost nothing. These accumulations of sediment are illustrative of the second class of difficulties, namely:

(2) THE SUSPENDED MATTER IN TRADE WASTES

This consists largely of spent lime, hair, strips of hide, particles of flesh, etc., which, when once allowed to settle in the sewer, compacts into a pasty mess which can only be removed by scouring or mechanical cleaning.

To remedy this condition, the industries were required to submit their waste to subsidence before discharge into the sewer. The quantities of suspended matter in the wastes, however, were so large and the basins so often too small or neglected, that the difficulties, even at this writing, have not been entirely overcome. A patented device, known as the Dorr clarifier, has helped to overcome the difficulty in two of the worst cases. This clarifier is a circular subsiding basin in which the waste enters at the center and is discharged at the circumference. The sludge which subsides to the bottom is moved constantly toward the center by means of plows attached to revolving radial arms. The sludge so moved to the center is pumped to a loading bin, which, in

turn, discharges the thick pasty sludge into carts to be hauled away. The advantage of this device over hand-cleaned subsiding basins is greatest where large amounts of sludge are handled. It discharges sludge continuously, thus maintaining the efficiency of the basin for subsidence, and almost compels the proper removal and disposal of the sludge.

In addition to the subsiding basins, screens have been installed to remove the hair and hide from the waste before subsidence. These minimize the compacting of the sludge both in the subsiding basin and in the sewer, and greatly facilitate the removal of the sludge from either hand-cleaned or mechanically cleaned basins.

(3) EXCESSIVE AMOUNTS OF FAT AND ORGANIC MATTER

Wool-scouring waste, which is the soapy, alkaline liquor in which wool is washed prior to combing and spinning, is a good example of this class. The composition of wool waste depends very largely upon the character of the wool scoured. Wool from our own territories and from South Africa is often very dirty, while some domestic and most Australian wool is quite clean. The dirt consists chiefly of sheep manure and particles of soil over which sheep have grazed. It also contains other foreign matter, such as fibre, burs, etc. This waste is usually very concentrated. It may contain 3 per cent of solids, of which one-third may be fats. The fats are of two kinds—first, wool grease or lanolin, a waxy substance which is present in the raw wool, and second, the fats combined with the soaps used for scouring.

The experience at Hudson, Mass., has illustrated the difficulties which this waste causes. Prior to 1909, the waste from a wool-scouring plant was discharged into the Assabet river. Complaints resulted in the discharge of the waste into the town sewerage system, and its attempted disposal by septic tanks and intermittent sand beds. In a few months the sand beds were completely clogged and had to be renewed, and the scouring waste was again discharged into the river. Then complaints by parties below resulted in the construction by the company of an acid wool grease recovery plant. In this, the waste was treated in tanks with sulphuric acid or nitre-cake—the whole being stirred with air. After the subsidence of the sludge, the partially clarified acid liquor was discharged through sand filters into the river. The effluent from this plant usually had an acidity of 2,000 p. p. m., and contained less than 50 parts of fats. The sludge was discharged on sand beds, dried, made into burlap-wrapped "puddings" from which the grease was hot-pressed in steam-jacketed hydraulic presses.

However, the treatment of the waste with acid produced a local nuisance, due to the acrid odors given off from the acidified waste, and suits were brought by neighboring owners to recover damages. The company therefore determined to change its method of operation. Acid treatment was abandoned, and the heated and settled waste

was passed through centrifugal machines, and the effluent, after filtration through the sand, was discharged into the stream. This process removes about 50 per cent of the fats as compared with about 95 per cent removed by the acid process, and it is questionable whether the discharge of the soapy effluent is desirable. The effluent possesses an advantage over the effluent from the acid process in that it is not acid, and while it contains more fats, they are either combined in the form of soap or are so thoroughly emulsified that they are cared for by the streams without offense. The appearance of the stream at the point of discharge is not so good as when the acid waste was discharged.

During the war, the removal of fat was a very profitable process. With present prices, however, the cost of recovery per pound of grease is slightly greater than the selling price.

(4) PRESENCE OF MINERAL OIL

Increased use of fuel oil is placing an increased burden on sewage works. The large factories store large volumes of oil in tanks. In these, paraffine-like bodies settle out, which, when discharged into the sewers at times of cleaning, coat their insides, and when conveyed to sewage disposal works cause a great deal of clogging. So far, examples of this effect are neither numerous nor as yet serious, but municipal officers are fearing more trouble on this account.

(5) FREE ACID

Certain sewerage systems receive the drainage from mines; others receive the so-called "pickling liquor" from plants where steel plates or wire are scaled by immersion in sulphuric acid. This factor is most important in cities like those in the Pittsburgh region where there are large steel wire and plate mills. At Worcester, Mass., acid waste is discharged at certain times of the day, and is stored in tanks so that it may be distributed uniformly throughout the twenty-four hours and thus be neutralized by the rest of the sewage.

Recently a patented process has been used to treat acid wastes of this kind. Lime or powdered limestone is added to the waste, and the precipitate is recovered in a continuous subsiding basin of the Dorr type. The sludge so produced is recovered and used for the purification of illuminating gas.

(6) PRESENCE OF BACTERIAL POISONS

The wastes from many tanneries where arsenic is used, and sewages containing free chlorine and copper salts may not be purified by bacterial action. The sewage of the East street sewer at New Haven is an example of this, as are also the sewages of many other Connecticut cities largely engaged in the manufacture of brass and copper articles. At New Haven, Professor C. E. A. Winslow, in a long series of experiments, determined that this sewage could not be purified by the activated sludge process because of the poisonous action of the copper salts contained in the sewage, and recommended that the waste be acidified with sulphurous acid and the sludge

produced by this treatment be dried and degreased to recover fats and fertilizer, following the methods recommended by Hatton for the utilization of sludge at Milwaukee. The process is known as the Miles process and has been described before this society.

(7) THE PRESENCE OF ACIDS RESULTING FROM THE FORMATION OF CARBOHYDRATES

In the manufacture of lactic acid from starch, and in the manufacture of sugar, whether from beets or from cane, there is produced a waste which ferments quickly and rapidly with the production of lactic acid, also small quantities of butyric and other foul-smelling compounds. Similar decompositions take place in the waste whey (containing sugar discharged from cheese factories) when an attempt is made to dispose of wastes containing it by subsidence. They ferment rapidly until enough lactic acid has been produced to stop fermentation. The addition of lime causes fermentation to begin anew, but the calcium lactate formed by the addition of lime also decomposes with the production of butyric acid and other disagreeable compounds. Further decomposition in the presence of sulphates causes the evolution of hydrogen sulphide.

An attempt by the writer to dispose of this waste by treatment in tanks and on trickling filters has not proved successful. Pearce and Greeley, in experiments with the waste from beet sugar factories, have shown that successive treatments with lime, each treatment followed by filtration, will produce effluents suitable for discharge into most streams. How to purify it for discharge into the beds in the dry season, a crying need in Cuba, is a question that has not yet been answered. The best solution which has been offered is to remove the saccharine bodies by an alcoholic fermentation, using yeast, and to dispose of the waste so treated by subsequent subsidence and filtration, with or without the addition of lime as may be necessary.

It is as a local nuisance that the problem is of interest to municipal officers. At Mansfield, Mass., a lactic acid factory was established near the residential section of the town. The solid portions of the waste were discharged upon filter beds, the effluent from which was in a putrefying condition. The liquid portions were discharged into a swamp in which they created an intolerable nuisance, killing vegetation and producing deposits of black sludge smelling strongly of hydrogen sulphide and rancid butter. No solution of this problem was ever worked out, for the company gave up business while a suit by the town against them was pending.

The citation of the above cases is enough, the writer believes, to give an idea that trade wastes show far greater variation in character and kind than do ordinary sewages, and each waste is a problem by itself. Municipal officers, therefore, in designing sewerage systems, should carefully consider the industries which the system is to serve, and where new industries are projected, the character of the business should be carefully determined with respect to its effect upon the

sewerage and particularly the sewage disposal system, if such there be.

Since the days of Herbert Spencer, scientists and economists have deplored the loss of values by the discharge of the wastes of human life and industry. While the word conservation has a taking sound, and there is great opportunity for its employment in the industries, opportunities for disposing of water-borne wastes at a profit are few. During the war, wool grease could be recovered at a profit; and some recent studies here and abroad promise the profitable recovery of grease and fertilizer base from certain wastes and sewages. But on the whole, the recovery of valuable products from water-borne waste cannot hope to be a profitable business. On the other hand, it can, in many cases, minimize the cost of disposal and at the same time conserve valuable by-products.

In the eastern part of the United States, the necessity for studying the trade waste problem is increasingly pressing. This study was neglected during the war, although the war industries polluted many streams as they were never polluted before. The conditions of rivers like the Blackstone, the Passaic and other smaller rivers are largely due to the discharge of trade wastes, and in many places the removal of these wastes is demanded. In some cases they must be discharged into the municipal sewerage systems; in others, separate disposal by the industries must be insisted upon. In any case, each problem is like no other, and must be studied in the light of its own surroundings.

Garbage Collection in Sacramento

The Capital City Scavenger Association, which had been collecting garbage in Sacramento, Cal., under contract, recently lost its equipment and barns by fire and if it is to continue in business it must purchase a large amount of new equipment for that purpose. Immediately following the burning of the equipment, the city commissioners arranged with the State Highway Commission for the use of automobile trucks owned by that commission for collecting garbage and carrying it to the city incinerator or the dump. Following the fire, the scavenger association stated its unwillingness to renew garbage collection unless it was given a contract for 10 years to justify it in an investment in a new equipment. The commissioners at last account were undecided as to whether to endeavor to arrange with this or another private company or to undertake municipal collection and disposal.

The president of the city commission, C. A. Bliss, believes this to be an opportune time to consider municipal collection and disposal of the garbage, and the matter is now being discussed and seriously entertained. Commissioner Bliss is reported as stating that the various civic bodies of the city are all in favor of this move. The city is spending about \$10,000 a year for destroying garbage and the possibility is suggested of reducing the expense or turning it to an income by garbage reduction or hog-feeding.

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Conservation of Water Supply

Wasted water costs money, even when the water flows by gravity and is not purified or otherwise treated.

One of the larger cities of New York States is to have this fact brought home to it by an increase of one-third in the water rates charged by its municipal plant, which increase is made necessary by the large sum spent in building the additional conduit and reservoir required to increase the capacity of the system for supplying the city with water. We do not mean to imply that in this particular case the citizens are unusually wasteful; but it is extremely probable that if they would all exert ordinary care in preventing any waste or loss of water, the expense which necessitated this increased rate could have been avoided or at least postponed for a number of years. Other cities, some in sections where water is scarce and others in sections where the population is dense, are rapidly approaching, if they have not already reached, the point where actual inability to increase the supply will compel economy in its use.

What amount of water is really necessary for legitimate use is discussed in this issue by Mr. Saville, and he produces some recent figures gathered in well-metered communities to indicate what may be considered a legitimate rate for domestic and other uses. His figures confirm what has been said heretofore, that the majority of cities are using at least double the amount of water necessary for all reasonable needs. Mr. Saville also, however, gives prominence to the opinion of a number of leading engineers that even legitimate uses are increasing slowly but continuously, and that what may be considered a reasonable amount of per capita consumption at the present time may not be sufficient for all legitimate needs of fifty years hence.

Whether the impelling agent be a limited supply of water or the cost of increasing the present supply, there can be no question that the cities of the country are being forced to a realization of how wasteful they have been in the past and to make some effort toward cutting down their extravagant waste of both water and municipal expenditures.

Draining Wet Sand

Whenever a stratum of fine sand is permanently saturated it becomes more or less fluid, yields readily to pressure, has an extremely small angle of stability, and is likely to bleed and flow underground or even to boil up in the bottom of pits, making excavation in it dangerous and costly. If the sand is very fine and there is an abundance of water it has many of the properties of real quicksand and is likely to be called quicksand even if it has not the micaceous or earthy particles that make true quicksand so greasy and slippery.

Excavation in it by ordinary methods gives a great deal of trouble and even with careful protection is likely to cause depressions in the surface of the adjacent ground or injuries to nearby structures and to require very careful and ex-

pensive bracing and sheeting for the sides of the excavation.

Most of this trouble is due to the presence of too much water in the sand and if this can be removed the difficulties will be greatly diminished. During the last twenty or thirty years many instances have been noticed where the excavation of deep pits in the lower part of Manhattan island (where many large buildings with deep foundations have been constructed in a notable quicksand area) have drained the water from the ground for a considerable distance and have thereby materially changed its character and condition. The ground water level has been temporarily lowered at nearby points during the construction of the work and in some cases it has been permanently lowered over considerable areas by a large number of deep excavations that, in some instances, have deprived foundation timber of its saturation and permitted decay that necessitated repairs, changes and reconstruction which would otherwise probably never have been necessary.

In some of the deep subway construction heavy pumping was maintained for many months and lowered the ground water level several feet, permitting work to be done that could not otherwise have been safely attempted.

At the recent excavation on the Jersey coast, mentioned on page 516, where the seashore sand was very unstable on account of saturation, a deliberate system of constant pumping from numerous points in a line enclosing the excavation a little below the bottom of the pit very rapidly drained the required area and kept it dry during the execution of the work so that no difficulty was experienced either from wet bottom or from the caving in of the sides, which became dense and stable and maintained vertical faces without the necessity for costly sheet piling and obstructing braces that would otherwise have been required.

Another example is that afforded by the construction of the outlet for the Ralph avenue storm water sewer in Brooklyn, where many hundred feet of a very wide trench was excavated to a maximum depth of 26 feet. A wide trench was excavated more than 20 feet below ground water level and the work was done without any difficulty whatever, simply by reason of the method employed of following up the excavation with open jointed wooden sheeting through which the water entered freely and was collected in open ditches left alongside the sewer and leading to sumps in which several pumps were installed and constantly operated, thus draining the sand so thoroughly that it exerted comparatively little pressure on the sides of the trench and kept the bottom dry. In this case the sand, which was a sharp and moderately coarse, excellent concrete sand, showed a steep angle of ground water surface from the sides of the trench to points near the surface of the ground where the level corresponded closely to that of the adjacent Jamaica bay.

The installation and operation of artesian wells has demonstrated some of the features of the flow of water through sand so that approximate calculations may be made of the drainage radius and

of the slope of the ground water surface or water table around well points driven to different depths and operated by adequate pumps. The preliminary investigation of the site accompanied by driving well points, sinking sumps, diverting surface water and preliminary pumping might often save the engineer and contractor a great deal of time, labor, and money when excavations are to be made in quicksand.

Contractors Repudiate Compromise With Blackmailers

The Bulletin of the Associated General Contractors of America, the most powerful and high-principled construction organization in the world, says:

The action of the Lockwood Committee now investigating the building situation in New York was endorsed at the meeting of the Executive Board in Washington, November 16, by resolutions adopted unanimously.

Plans were laid for securing the co-operation of the United States Chamber of Commerce and other employers' associations in urging the Lockwood Committee to "pursue its investigation without fear or favor to the end that all guilty be exposed and punished, and that justice thereby be done to those who, condemning the purchase of immunity from labor troubles by the corruption of labor officials, desire an honorable settlement of the labor problem based upon fair dealing."

The resolution follows in full:

"Whereas, The Lockwood Legislative Committee has uncovered a corrupt state of affairs in New York City in which a group of owners and contractors has sought to prevent and settle disputes with labor organizations by the payment of tribute or so-called graft to certain labor officials; and,

"Whereas, The same condition of affairs may exist in other lines of industry; and,

"Whereas, This condition reflects discredit on the whole construction industry and until the matter is entirely sifted and the names of all of the guilty parties disclosed the whole industry, the second largest in the United States, is on trial and stands discredited in the eyes of the public; and,

"Whereas, Former legislative committees, operating upon similar lines, have not always carried their investigations to the ultimate conclusion so that the guilty ones were exposed and punished.

"Therefore, be it resolved,

"1. That the Associated General Contractors of America is in entire sympathy and accord with the investigations of the Lockwood Committee.

"2. That the Associated General Contractors of America invites the Chamber of Commerce of the United States, other organizations and employers generally throughout the country to join with it in asking the Lockwood Committee to pursue its investigations without fear or favor to the end that justice thereby be done to those who condemning the principle of the settlement of, or purchase of immunity from, labor troubles by the corruption of labor officials desire an honorable settlement of the labor problem based upon fair dealing.

"3. That a copy of these resolutions be sent to the Lockwood Committee, be given publicity through the press, be spread upon the minutes and sent to members of the association."

Wanaque Dam Begun

After several years of legislating and negotiating, work was begun on the Wanaque dam (described in PUBLIC WORKS, April 17, 1920), on November 23, when the first sod was turned by the presidents of the North Jersey District Water Supply Commission and of the City Commission of Newark.

The cost-plus contract will be described next week.

Legitimate Use of Water

Under the title, "What Is the Legitimate Use of Water?" C. M. Saville, manager and chief engineer of the Hartford, Connecticut, water board, presented some recent figures and a study and discussion of them before the New England Water Works Association, a synopsis of which is given in the following article. The subject is one of great interest to water works engineers in connection both with their planning for capacity of future supplies and their forming a decision as to the probability of leakage or waste in existing systems.

The primary object of a water supply is to serve the people with a necessary commodity in as economical and efficient a manner as possible. Both total amount used and rate of use are important, the former in connection with selection of drainage area or other source of supply, the latter especially in relation to the designing of distribution systems and appurtenances.

There may be an increase in per capita consumption from year to year or a difference in consumption between cities which is not due to waste but has legitimate cause. Such difference may be due to the basis on which the number of consumers is estimated, but actual increase in rates may be due to the character of the houses, developing of use of plumbing fixtures, extension of sewers and provisions for modern personal convenience, the pressure under which the water is supplied, and the requirements for mechanic arts and commercial purposes. During the past fifteen years the equipment of tenement houses with plumbing fixtures has developed greatly from the former conditions of merely a cold water faucet and one toilet to a building or a floor. These changes cause great increase in per capita domestic demand during a transition period of perhaps 20 years in suburban and country localities, and thereafter a more slowly advancing rate, tending to approach a constant rate of consumption. For the transition period the rate of increase per capita per year may be two or three gallons more than the present normal, and thereafter may drop to one-half to three-quarters of a gallon.

CONSUMPTION IN HARTFORD

The city of Hartford is practically 100 per cent metered, the only unmetered supplies being fire protection services and some use of water for street watering, flushing sewers and water mains, and fire hydrants. In 1915 an intensive study of consumption was made and it was found that domestic consumption averaged 33 gallons per capita per day, manufacturing 19 gallons, public use 3 gallons and unaccounted for 10.5 gallons; a total of 65.5 gallons. The total consumption averaged 9.40 million gallons per day. In 1919 this had increased to 11.88 million gallons and, while no close study has been made, it is believed that the unaccounted for water is less than 15 gallons per capita, or 20 per cent of the total consumption.

In Hartford the water used from the public supply for manufacturing and industrial purposes is low because much of the water so used is furnished by private supply from driven wells and streams. But for this, both the manufacturing consumption and the total would probably be appreciably larger.

Public—Water used for public supplies is believed not to exceed 450,000 to 500,000 gallons per day, or 157.5 million gallons per year, of which the fire department uses 3.7 million for station use and 3.3 for extinguishing fires; the parks use 11.7 million, the schools 24.7 million, miscellaneous buildings 20.8 million, and the street department uses 34.1 million for sprinkling and flushing and 3.1 million for other purposes; while 55.2 million is unaccounted for. The use for fire purposes is very low per year but may be high per minute. It averages less than one-half pint per capita per day. From the records of the fire department for 1914 the following figures were obtained: 628 alarms, 105 fires at which water was used, water pumped 63 times, average length of hose line 380 feet, average hydrant pressure 60 to 80 pounds. The duration of hose service averaged 15 minutes at 50 fires, 15 to 30 minutes at 25 fires, 30 minutes to 1 hour at 15 fires, 1 hour to 2½ hours at 11 fires, 2½ to 4 hours at 2 fires, and 4 hours to 6 hours at 2 fires. At only 16 fires were more than 2 streams used, at 7 fires more than 4 streams were used and at one fire 13 streams were in service.

Mr. Saville gives tabulated data for the seven fires at which more than 4 streams were in service, and these show a total amount used of 648,380 gallons as a maximum where 13 streams were used, and 35,770 as a minimum where only 5 streams were used. These seven fires used a total estimated amount of 2,182,190 gallons, or about two-thirds of the entire amount used during the year for putting out fires, leaving an average for the other 98 fires of about 11,400 gallons each. These quantities were estimated by calculations based on the size of nozzle, length of fire line and pressure. These gave a maximum rate of discharge for the 13-stream fire of 4,765 gallons per minute and a minimum rate of 1,120 gallons for 5 streams. A fire occurred in 1917 at which 13

pumping engines and a water tower were used and resulted in a loss of \$613,000. Twenty pieces of apparatus were in action and in all the equivalent of 38 single streams were employed simultaneously. It is estimated that about 3½ million gallons of water were used at this fire and that for four consecutive hours the draft was at the rate of 10,000 gallons per minute. This rate, it is interesting to note, is exactly that recommended for Hartford's congested district by the engineers of the National Board of Fire Underwriters in 1916.

Unaccounted for water is due to leakage from underground water mains and services, under-registration of meters, and probably from illegitimate use and some unmetered public uses. Dexter Brackett, in his report on the Boston Metropolitan Water District, stated that 15 gallons per capita per day was a minimum which "could only be maintained by a thorough meter system and constant inspection." John R. Freeman, in his report on New York's water supply, gave 10 gallons as "the irreducible waste with every service pipe metered and most rigid inspection."

Domestic Consumption—Proper and legitimate rates of use for domestic purposes involve many factors of human habits and social requirements as well as necessities. Figures were given by Mr. Saville for five Massachusetts cities which are similar in their characteristics and are practically residential communities having no large industries and which have all been fully metered for ten years or more. In these communities the per capita consumption in 1914 varied from 40 to 65 gallons, averaging 51.8, while in 1918 the consumption had increased to from 47 to 76 gallons, averaging 62.7. This shows an increase in consumption of 21 per cent, and during the same period the population had increased 13 per cent, giving an average increase in per capita consumption of about 7 per cent. The increase in per capita consumption in the individual cities varied from 1.4 to 3.2 gallons per capita per year, or 7 to 16 gallons for the 5-year period.

Messrs. Freeman and Stearns, in reporting on the Baltimore water supply, stated that there is a strong tendency in nearly all the large American cities for the per capita supply of water to increase from year to year.

In a certain district that purchases water from the Hartford water department 1,878 persons were served by 379 connections, all metered, and the average use was 25.2 gallons per capita. By meter rates at 12 cents per hundred cubic feet and a minimum charge of \$5 per connection, this

district paid \$3,414 for water last year, an average rate of about \$9 per connection. An average of fixture rate charges paid to 27 private water companies in Connecticut similar in character to this district gave the following rate schedule in force prior to 1918: Single family or faucet \$6 per year; one water closet, \$4; one bath-tub, \$4; two set-tubs, \$1.50; sill-cock or use of hose, \$5; each additional closet, \$1.50 each additional bath-tub \$2, horse or cow, \$4. Meter rates by private water companies ranged from 25 cents to 40 cents a thousand gallons, the majority of the companies charging 30 cents. On the basis of these figures, the cost by fixture rate for a single family with 1 water closet, 1 bath-tub, 2 set-tubs and a sill-cock would be \$20.50, which would give a cost per thousand gallons of 56.2 cents if the consumption were 20 gallons per capita per day, 45 cents if 25 gallons per day, 37.4 cents if 30 gallons per day, 28.1 cents if 40 gallons and 22.6 cents if 50 gallons. As compared with a meter rate of 30 cents, meter rates would apparently be cheaper for anything less than about 38 gallons per capita per day.

In the district studied, 48 premises with single faucets and accommodating 300 people, had an average daily consumption of 8.8 gallons per capita per day; of which 48, 14 had a consumption of 6 gallons per day or less and 9 a consumption of 12 gallons or over. Houses without such modern conveniences as bath-tubs, water-flushed toilets and set-tubs with running water, average about 9 gallons; while 75 fully plumbed houses in this district accommodating 312 people used an average of 28.4 gallons per day.

It would appear from this analysis that the cost of metered water is ordinarily cheaper to the consumer than by fixture rates and he is thus led to more lavish use; while on the other hand the general installation of meters tends to cut down waste of water. The net result of this may be that, while legitimate household use of water seems to be increasing, the amount pumped or drawn from storage reservoirs is only slowly affected.

Mr. Saville concluded his paper with two tables, one showing the use of water in 16 dwelling houses in Hartford of various character and conditions of plumbing, and the other giving a summary of the use of water in 661 premises of various kinds housing 5,937 people and believed to be representative of average conditions in Hartford. Of the 16 residences in the first table, the assessed valuations varied from \$1,500 to \$45,000, the number of tank closets from none to 10 and of flush closets from none to 7, the number of wash basins

Total and Average Consumption in Various Classes of Houses

	Services	People	Cu. Ft. per year	Per Service People	Per Service Gallons per day	Per Capita Gallons per day
Apartment Houses	9	462	1,394,300	51.4	318	62.0
Six Tenement Houses	76	1,602	1,987,000	21.0	536	25.5
Three Tenement Houses	65	828	1,145,400	12.5	355	28.4
Two Tenement Houses	208	1,543	2,268,100	7.4	223	30.0
Single Houses (3)	128	570	866,700	4.5	242	45.7
Single Houses (2)	138	743	1,630,100	5.4	242	45.7
Single Houses (1)	36	189	748,900	5.3	427	81.4
	661	5,937	10,040,500	9.-	312	34.4

from 1 to 9, of bath-tubs from 1 to 7, of set-tubs either 2 or 3, of shower baths from none to 7. The occupants varied from 2 to 11. The gallons per capita per day varied from a minimum of 25 to a maximum of 133. In every case the maximum figure was for the one residence assessed at \$45,000. Omitting this, the maximum consumption was 88½ gallons, with 4 tank closets, no flush closets, 4 wash basins, 4 bath-tubs, 3 set-tubs and no shower baths.

The second table divides the buildings into apartment houses, six-tenement houses, three-tenement houses, two-tenement houses and single houses. The totals and averages arranged under these several classifications were shown in the table on the preceding page.

All these premises have been metered for a number of years and it is reasonable to suppose that the use of water in them has become stable.

Water Power in Alabama

Nearly half of the state of Alabama is served with electric power by a dam on the Coosa which generates 90,000 horsepower. A new Coosa dam is being constructed and also one at Muscle Shoals, the former of which will ultimately generate 120,000 horsepower, and the latter is being equipped with machinery to generate 300,000 horsepower. Thus these two plants will add more than four times the present power consumption, giving a total of over 500,000 horsepower.

Altogether there is, it is said, more than 1,000,000 horsepower available for development in Alabama, which should serve as a great stimulant to the expansion of present industries and the establishment of new ones. The two new plants are expected to be in actual service within the next two years.

\$52,000,000 Dam and Irrigation Work in India

A great dam and a series of high-level canals on both sides of the Indus river are planned to irrigate approximately 5,000,000 acres of land for food and cotton growing. The dam will be about one mile long and the two canals will supersede existing ones on both sides of the river. There will also be required a levee 105 miles long for flood protection. Plans and specifications for the whole project have been submitted to the Government of India and it is expected that they will receive the sanction of the secretary of state so that arrangements for work can be begun at an early date. For work of this magnitude, even in a country where labor is plentiful and cheap, American types of construction and machinery which are unexcelled in the world should find place and American methods may justify attention of interests here that are waiting for a resumption of construction on a large scale in this country.

Concrete Lining For Cast Iron Tunnel Shells. III*

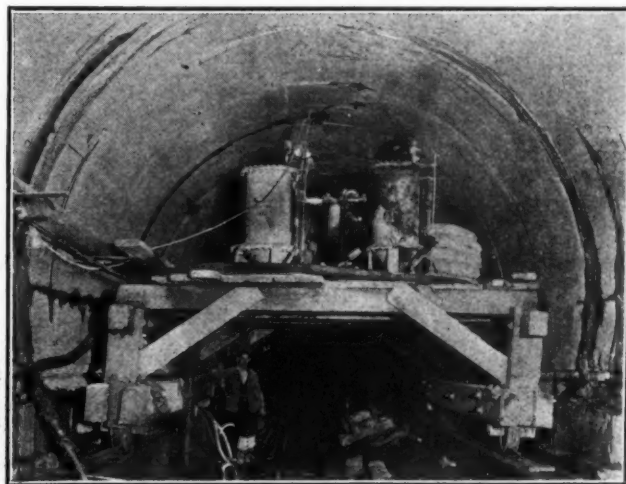
Grouting the concrete lining to fill the voids under the flanges of the lining rings, using 60 pounds pressure.

In all previous construction of tunnels with cast iron linings, great difficulty has been experienced in filling the concrete around the under sides of the projecting inclined webs and flanges. Concrete, especially when fine and wet, maintains a horizontal upper surface and it has always proved quite impossible, even when subjected to considerable pressure, to force it into spaces elevated above the inlet. Voids therefore are bound to appear in the triangular spaces under the inclined webs and flanges in the upper segments that project into the concrete lining.

These were, of course, anticipated and inevitably occurred throughout the 17,500 linear feet of single track cast iron lined tubes of the East river subways at 60th street, at 14th street, at Old Slip and at Whitehall street, where the 1:2:4 concrete made, with the ¾-inch aggregate and having an average thickness of 14 inches, was placed with great care and rammed or spaded wherever possible, to give it maximum density.

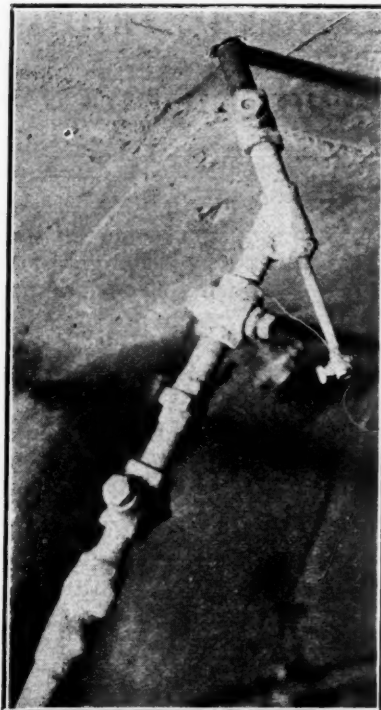
Although the clearances were sometimes very small, especially where there was any irregularity of alignment causing reduction of clearance between the forms and the edges of the ribs and flanges, the concrete was so carefully placed that a smooth, dense arch soffit was secured and efficient measures were taken to locate and fill all of the small voids near the extrados of the arch.

*Part I, Mixing and Transporting Concrete, was published September 18, and Part II, Steel Forms, Travelers and Concreting, was published November 13.



HIGH PRESSURE GROUTING PLANT WITH TANKS AND COMPRESSOR

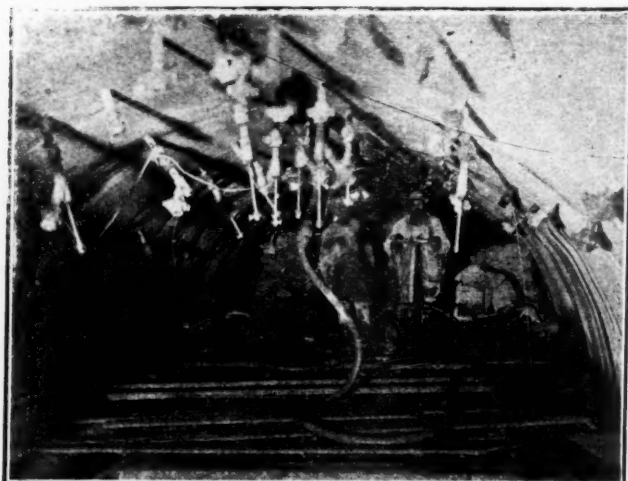
The cast iron lining rings were assembled with key panels and plate panels alternately at the crown. The former arrangement was such that there were always in each ring three segments with voids under the upper flanges, thus necessitating the drilling of three grout holes. In the plate arrangement there were only two inevitable voids and only two grout holes were therefore always necessary, and were made singly or in pairs according to the methods employed.



SPECIAL CONNECTION FOR
GROUTING AND VENTING VOIDS
IN LINING

After the forms were stripped, the smooth and uniform surfaces of the concrete were everywhere carefully examined and sounded to detect any hollow or unsound places, and where these were visible, the defective portions of concrete were cut out and replaced. Where they were not visible but were indicated by tapping or other methods, holes were drilled and as much grout was forced in under pressure as could be received.

In some cases provisions were made for marking through the forms, on the fresh concrete, the location of ribs and flanges situated so as to obstruct the concrete and probably cause voids. In other cases where this was not practicable, after the forms were stripped, measurements were made from fixed points to locate such places and they were marked and all of them were drilled to per-



GROUTING INSIDE CAST IRON LINING

mit the insertion of the grout tubes.

Grout, made with neat cement mixed by hand and hand pumped, was mixed to a soupy consistency in machines of the pneumatic and paddle wheel types, and forced under about 60 pounds pressure into the cavities in the lining which on the average required about $1\frac{3}{4}$ bags of cement per linear foot of tunnel.

At some of the points located for grouting, as in the 60th street tunnel, a single 2-inch hole was made through the concrete lining by a jackhammer drill operated by compressed air, and in it a steel nipple was inserted and tightly calked with oakum. To this nipple there was connected a sleeve with a short length of 2-inch pipe terminating in a Y with one branch reduced to receive a $\frac{3}{4}$ -inch vent pipe and stop cock, and the other connected to a 2-inch coupling that later received the grout pressure pipe. In other places, comprising a large proportion of the work, two holes were drilled into each cavity, one used for filling and the other for venting and thus dispensing with the Y fittings.

After a sufficient number of these connections had been set, the grouting gang of five men injected grout under pressure into each cavity and when it would receive no more grout, closed the valves so as to maintain the pressure; when the grout pipe was removed, connected to another nipple and so on, until all had been served at the rate of about 100 linear feet of tunnel in two or three days. Usually one grouting sufficed, but in some cases the cavities were grouted a second time.

In most cases the grout was mixed by hand and was forced into the lining by hand pumps. In other cases, it was mixed under high pressure in Caniff grout tanks provided with air from a Westinghouse compressor, the plant being on East 60th street. In this case the tanks were cross-connected so that they could be used independently or in combination, and so that one would afford a reserve, permitting the other to be put out of service without stopping the work. The Ransome-Caniff grout mixer and placer was also used in the Montague street tunnel.

Rails were laid on the lower benches of the duct banks, making a track of about 12-feet gage on which there were installed small wooden gantry travelers mounted on four wheels giving full horizontal clearance and about 8 vertical feet clearance for cars and locomotives under them. The traveler caps carried horizontal platforms at about the springing line. Some of these travelers were used merely for working platforms for drilling the holes and inserting the grouting nipples, and others were used for the grouting gangs and their equipment.

The tunnel lining was executed under the direction of D. L. Turner, chief engineer, Robert Ridgway, engineer of subway construction, and of C. M. Holland and C. D. Drew, successively in charge of the Tunnel Division. All of the different contracts here mentioned were awarded to Patrick McGovern & Company and to Booth & Flinn, Ltd.

Delaware State Highway Department II*

Organization of department; division into bureaus of survey, design, construction, maintenance, general office, and economics, working force and equipment.

The Highway Department of the State of Delaware which, as stated in the previous article, was created in 1917, consists of the Governor, John G. Townsend, chairman, and four other members. The principal officers are Charles M. Upham, chief engineer, and George W. Francis, secretary, and a staff at present consisting of about seventy persons at headquarters in Dover and, most of them, located throughout the state. The secretary is officially in charge of auditing the finances of the department and, with the chief engineer who is the administrative head of the department, is directly responsible to the State Highway Department and through it to the General Assembly and the people of the state. The department is divided into seven bureaus, each in charge of a division engineer acting under the direction of the chief engineer or of principal assistant engineer Samuel Knopf.

The *Bureau of Surveys* in charge of Arnold Richardson, assistant engineer, has two or more survey parties in the field as required, with necessary draftsmen and clerks in the general office.

The *Bureau of Design* in charge of assistant engineer C. N. Conner makes the plans and estimates for new construction, including drainage. Plans are laid out according to the latest methods adopted by Federal Government and closely follow

analyze any job long after it has been completed. These post mortem charts give the length of slabs, the date laid, maximum and minimum temperatures, location of joints and cracks, kinds and proportion of all materials entering into the slab, condition of sub-grade, and direction of mixer. All additional cracks, as they develop from year to year, are put on these charts, showing a comparison of slabs with and without reinforcement, number of cracks in certain slabs against number of cracks in slabs of various lengths, and comparison of slabs with and without lime. There are charts showing different contracts but using the same kind of materials, same proportions and sub-grade condition and the same length of slab, which are observed for a period extending over fifteen or twenty days. It is found that, regardless of the length of slabs, the number of cracks will follow in close proportion, depending on the maximum and minimum ranges of temperature during the period. Construction charts graphically illustrate the entire job with a legend of just what materials entered into the contract. Experimental charts define movement of slabs that have been measured monthly by a Bureau of Standards man, and the variations recorded. Other charts show the use of lime and concrete. Considerable study has been expended along this line for the development of a

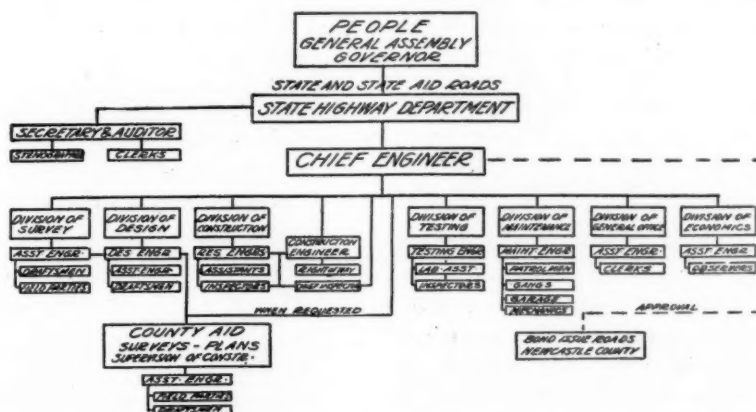


CHART OF ORGANIZATION OF DELAWARE STATE HIGHWAY DEPARTMENT

their standards, the one exception being design of bridges and culverts, which, on account of the smallness of the state, all are given individual designs.

There are maintained complete record charts of each finished road, which make it possible to

better concrete.

There is at present a force of nine resident engineers, each of them supervising from one to six contracts with from one to four inspectors, many of them technical graduates selected with great care and encouraged to make their best efforts by being promoted, as rapidly as their merits justify it, to positions of resident engineers.

*Part I, History and development of departments, was published November 13th.

The *Bureau of Maintenance* is in charge of assistant engineer Elmer V. Cushman, who is also in charge of the Federal Aid Equipment.

Each road is identified by a route number and is divided into 1-mile sections.

All of the work is accounted for under specific headings such as roadway metal, shoulders, roadside and guard rails, ditches and drains, bridges and culverts, materials, sundries and supplies, cost per mile, cost per square yard, etc., and an accurate record is kept of the different items, including the plan and profile map, date and descriptions of operations.

The *General office Bureau* in charge of assistant engineer I Paul Jones, preserves all of the records and accounts, complete summaries of which are always instantly available. Minute histories of every contract, including classified costs, are kept in a ledger and all available data are kept posted up for the most convenient reference. This is done so thoroughly and promptly that the condition of every contract for the previous day is always known in the main office.

The *Bureau of Testing*, in charge of assistant engineer G. W. Hutchinson, is equipped with a laboratory and inspectors that have charge of testing all materials used in road construction. It passes on the quality of all materials purchased or used, and conducts researches and experiments. All of the ingredients, concrete, water, sand, stone, lime and cement are required to conform to the best standards and are thoroughly tested for chemical and mechanical results. The cement is subjected to compression and boiling tests, and comparative tests are made of road concrete taken from the structure and of those made at the laboratory.

The *Bureau of Economics* is in charge of assistant engineer W. W. Mack, who is also in charge of the Department of Right of Way and of Information. This bureau provides lectures illustrated with stereopticon slides, showing improved roads and operations; furnishes information published in the road bulletin of the Delaware Automobile Association giving the state of progress of different sections of road work, resurfacing and the like in Delaware and in contiguous parts of Pennsylvania and Maryland, with information concerning detours, closed roads, and the like. It has also prepared a public exhibition of road models, including a display of all tests now used in the department.

POST MORTEM RECORDS

The Delaware State Highway Department was the pioneer in devising and using what is called the "post mortem record," by which is maintained an up-to-date complete detailed history and chart by which every job can be analyzed at any time. Among the data recorded are the general date of the work, and length of each slab laid, the number of cracks and their location, the kinds of materials used, the proportions of materials, the conditions of sub-grades, weather conditions, maximum and minimum temperatures, use of hydrated lime, use of reinforcement, operation of mixer, and the name of inspector.

It is thus possible, after completion of a job, to detect and analyze faults, while no method has been

discovered for the complete prevention of cracks in long monolithic concrete, 50 per cent of them can be eliminated by good materials and good workmanship, and none need occur in slabs less than 100 feet long. The longest slab on record without a crack is 330 feet.

FORCE AND EQUIPMENT

It is the policy of the department to co-ordinate with technical training institutions and to make the qualifications for members of the engineering staff more exacting as the standard of highway engineering is developed. Definite training of a high grade is now required of all employees except laborers, and a system has been inaugurated for the employment during the summer of students specializing in highway engineering at Delaware College. Great pains are taken to promote personal ambition and zeal and *esprit de corps* among the staff by official encouragement, recognition and assistance. Staff banquets are held four times a year and there are weekly social gatherings.

During the summer of 1920 the average force consisted of nine resident engineers, one hundred inspectors, and one motorcycle policeman for every five to ten miles of improved road; and also, at headquarters, a draftsman and six stenographers and clerks.

The mechanical equipment included 4 two-passenger and 20 five-passenger automobiles; 37 automobile trucks of 2-ton capacity, 10 of them having hand-dump bodies, and all but three being equipped with solid tires; three-120 h.p. Holt tractors; one Warren Brothers No. 6 portable asphalt plant; one 3-bag Ransome building concrete mixer; one stiff-leg wooden derrick and hoisting engine; one locomotive crane for unloading, and one gasoline operated trench digger for drainage work.

For the operation of this equipment there was maintained a force consisting of 6 foremen and about 18 men distributed at convenient localities throughout the state to give immediate attention to necessary repairs and maintenance, all new construction work being executed by contract. It is intended to install as soon as practicable sand and stone storage at five different points and to build a garage and repair plant provided with an adequate force of competent mechanics.

DEPARTMENT FUNDS

The regular funds for the maintenance of the department are derived from automobile registration fees and licenses and from the excess state income tax revenue over \$250,000. The rapid increase in the number of automobiles owned and operated in the state have proportionately increased the road income from \$35,672 in 1914 to \$286,332 in 1919 and \$327,634 in the first six months of 1920. This revenue must provide for the maintenance of roads, for the maintenance of the highway department organization and for the fixed charges on the bonds issued. An income of approximately \$60,000 per year is available from the income tax. Construction is provided for by 40-year sinking fund bonds, of which \$1,100,000 have already been issued. During 1919 there was available from state money \$1,500,000 and an equal sum was contributed by General T. Coleman du Pont, making a total of \$3,000,000. The present organi-

zation has facilities for executing about \$5,000,000 worth of work per year.

Excavating and Loading Beyond the Reach of a Ditcher Machine

An excavation 18 feet deep for the bridge approach of a logging track near Shelton, Wash., was made with an American road builder and ditcher and a small drag-line machine.

The ditcher first made a cut 10 feet below the rails of its own track and dumped the material in cars on a bank 24 feet above its track. These dimensions of digging and lifting reached the maximum capacity of the machine.

Special provision was therefore necessary to dispose of the spoil for the second cut of 6 feet. This was provided by building on the bottom of the trench cribbing 6 feet high, made of old railroad ties. Five cribs were built, and sectional tracks laid on them on which the ditcher machine was operated with plenty of reach to excavate 6 feet below the base of the cribs and still to dump into the spoil cars on the top of the bank.

While the spoil cars were being dumped the cribs were shifted ahead, all of the ties for one crib being handled in two bundles by the excavator itself. The spoil cars were returned and the cribs and track shifted with an interruption to excavation of only fifteen minutes. The cribs were spaced 3 feet apart in the clear and the bed of each crib was leveled by four men who prepared and built the cribs with great rapidity.

The material handled consisted of 6 feet of loose top soil overlaying 10 feet of hardpan that, for the second movement of the ditcher, had to be blasted.

The spoil was loaded into 6-yard hand dump cars and deposited in a fill 2,000 feet long at the opposite end of the bridge. The machine excavated 450 yards daily for 21 days, loading a train of six 7-yard cars with 84 passes of the dipper in eight minutes. The 2 feet of sandstone in the bottom of the trenches was drilled, blasted and removed by the drag-line scraper bucket that, on account of obstructions, handled it twice and at a speed only one-fifth that of the ditcher machine.

Replacing Bridge Truss Bearings in Service

The $5\frac{1}{2}$ by $7\frac{1}{2}$ -foot by 12-inch base plates under the truss shoes of the Wabash Railroad bridge across the Mississippi river at St. Charles, Mo., were recently replaced by grillages of 12-inch I-beams without interrupting the service of the bridge.

Each of the two cast-iron base plates at one end of the 300-foot span rested on an 8x8-foot masonry shaft 30 feet high on top of a masonry pier about 70 feet high above rock bottom. As there was no room for lifting apparatus or clearance for removal of the plates on the tops of the shafts, and as the elevation was so great as to make the construction of ordinary falsework costly, a special lifting harness and jacking plat-

form were devised that saved time and money and enabled the work to be safely accomplished in a simple manner.

In planes parallel to the bridge axis, sets of four 12x12-inch vertical wooden posts were placed on each side of each of the masonry shafts, capped with 12x14-inch timbers flush with the top of the masonry, and connected together by transverse timbers, thus virtually forming falsework towers enclosing the masonry shafts.

On the 12x14-inch caps, eight 100-ton hydraulic jacks were set to support, for each truss, the ends of a pair of 24-inch transverse I-beams clearing the inclined end posts and carrying pairs of 12-inch longitudinal channels with $\frac{3}{4}$ -inch hanger plates bolted to them and bored at the lower ends to engage pilot nuts screwed to the ends of the end lower chord pins.

With this apparatus the 200-ton span was raised sufficiently to permit the longitudinal withdrawal of the old base plates, which were jacked out onto a suspended platform, after which the new grillages were rolled in from this suspended platform. The work was done by the Kansas City Bridge Co.

Six Million Dollar Canadian Pier

A \$4,500,000 contract has been awarded for part of the construction of the Ballantyne pier on Burrard Inlet at Vancouver Harbor, B. C. The pier, which will probably be completed within two years, will be 1,206 feet long and 341 feet wide with four 500x110-foot two-story steel sheds. The reinforced concrete pier will be supported on 7-foot cylindrical piers sunk to rock bottom and extending to a height of 45 feet above low tide. It will have double tracks on the outer edges and four tracks through the center, and will be equipped with improved heat and light and mechanical apparatus, such as unloading cranes, cargo chutes, elevator and escalators. It will have capacity for loading and unloading four large vessels simultaneously.

Coaling a Drag-Line Excavator

A Class 24 Bucyrus drag-line excavator used by the Gail & Regan Company, Chicago, contractors for excavating a 12-mile channel in Cottonwood Creek, Kan., was advantageously coaled by lifting the truck body filled with coal from the running gear by means of two chain slings attached to the boom of the drag-line machine, which hoisted it, rested the rear end of the body on the bunker and elevated it until the coal was dumped into the bunker, then returned the body to the truck frame; all in 5 minutes, as compared with about 30 minutes required for ordinary unloading.

Installing a Steam Shovel in a Deep Quarry

A 14-B Bucyrus steam shovel owned by the Wauwatosa Stone Company of Milwaukee was recently installed in their quarry by lowering it

in sections from the top of the vertical quarry face 75 feet high.

A pair of vertical shear legs equipped with heavy tackle was erected at the top of the quarry face and first lowered the 11,800-pound shovel base and set it in position ready to receive the revolving frame. The ventilator was taken from the frame and the hook of the hoisting tackle was lowered through the frame and fastened to the lower part. The frame was hoisted by mule power and the shear leg back stays were slacked off until the top of the shears overhung the quarry face and the 19,800-pound frame was lowered to position on its base. The time required for erecting the shear legs and lowering the shovel was about two days.

More New Piers for New York

The Cunard Steamship Line has announced preparation of plans for the erection of eight 1,000-foot piers and one smaller pier at Weehawken. They will cost about \$30,000,000. Their frontage, which has already been secured, is at present obstructed by a number of sunken wrecks. The first step will, therefore, be the removal of these obstacles and dredging to give proper deep water facilities.

Dock Commissioner Murray Hulbert has announced a municipal project for the construction of three docks 350 feet wide and from 700 feet to 1,000 feet long at Owl's Head Bay, Bay Ridge. They will be equipped with modern apparatus for cargo handling. The New York and New Jersey Port Commission has completed its report, including plans for extensive Staten Island and East river improvements.

It is authoritatively reported that in July the cost of production of lumber in large representative mills varied from \$30 to \$32 per thousand, showing an increase of more than 20 per cent in the last year.

It is officially reported at the hearings of the United States Senate Committee on reconstruction that the cost of construction work in Cleveland has advanced 167 per cent in the last five years.

Work on the Three-States Road Started

Work has been started on what is known as the Three-States road, which is the name given to a highway leading from Mountain Rest, S. C., to Highlands, N. C., which latter is said to be the highest incorporated town east of the Mississippi, being 3,820 feet above sea-level. This road is about 20 miles long, and will be confined to the Nantahal National Forest and will pass through parts of North Carolina, Georgia and South Carolina. The cost is estimated at \$220,000, which will be paid partly by the United States Forest Service, partly by Macon county, N. C., and partly by Oconee county, S. C.

New Jersey Roadwork Stopped by Injunction

The million dollar road construction program in Essex County, N. J., has been stopped by a temporary injunction granted October 29 to give opportunity to review the board's awards of contracts. All the contracts let are affected by this injunction except one contract which is now nearing completion. This however will not prevent the municipalities in the county from going forward with preliminary steps now under way, such as the preparation of cost sharing agreements, setting of curbs and making connections with sewers and other public utilities in the streets to be paved.

The counsel for the Chamber of Commerce of Newark who asked for the writ, advanced eight specific reasons but the writ was granted on the first alone, this being that the freeholders of the county were required by law to provide the funds for financing any improvement before they let the contract for it, and the court held that until the bonds actually are marketed the county cannot tell whether or not it has made an appropriation sufficient to meet the cost of the improvement, and that as the bonds have not yet been marketed for this work, the contracts cannot be let legally. The court believes that it was the intention of the law makers to provide that the actual money should be in the county treasury before the contracts were let.

Pumping Eliminates Sheet Piles

The construction a year ago of the \$1,500,000 Ambassador Hotel Annex, Atlantic City, involved a 150 x 300-foot excavation 18 to 24 feet deep through wet sand near the shore line of the Atlantic ocean, ground water being encountered about 10 feet below the surface of the ground.

The obvious method of holding up the sides and excluding the water by steel sheet piling was replaced by a system of sub-surface drainage, maintained during the construction work and for a very short period in advance, that kept the excavation dry and made the sand itself so dense and firm that it stood well with vertical faces without sheeting or bracing.

The site was enclosed by a 4-inch pipe line 2 feet below the surface of the ground, in which were inserted 2-inch nipples and tees 4 feet apart, connected by steam hose to 20-foot lengths of 2-inch pipe terminating in 6-foot well points driven and jetted down below the bottom of the future excavation.

The 4-inch pumping main was divided into independent sections by shut-off valves so that suction could be concentrated on any portion of it. It was operated by four triplex pumps that were kept running until the sub-structure walls and floors were built and waterproofed and a permanent drainage system of 6-inch pipes in graveled trenches were laid and connected to a sump. The Thompson-Starrett Company was the general contractor.

Immigration Notes

In a recent article in the "Brooklyn Eagle," the probable number of immigrants for the next year, 1921, is estimated at 2,000,000, about 90 per cent of which will enter through Ellis Island. Commissioner Wallis, in charge there, is quoted as saying that he prefers to refuse admittance to nine hundred and ninety-nine worthy immigrants rather than take the chance of admitting one unworthy immigrant. His slogan being: "When in doubt, deport."

The country needs almost unlimited numbers of efficient skilled and unskilled laborers who are willing to be Americanized and give honest reliable services. We do not need soap-box orators, radicals or people coming here with the purpose of getting the highest possible pay for the smallest possible services. It is estimated that, excluding women, children, old people, and other non-workers, only one-third of the immigrants now arriving are "workers with hands."

The greatest attention should be paid to the health and character of immigrants so as to exclude diseased, defective and vicious, particularly Bolsheviks and I. W. W.'s. It is reported that fully 8,000,000 Germans are anxious to immigrate to the United States as soon as they will be permitted to enter.

There is a strong demand for desirable immigrants for farm work in the Northwest and the governors of Minnesota, Wisconsin and North Dakota invite them to come, and offer inducements to them. Wisconsin has a fund of \$25,000 per year to assist immigrants and Minnesota has half a million acres of land open for homestead entry and nearly two million acres of unsold state land suitable for farming and vegetable growing at a minimum price of \$5 per acre, payable 15 per cent down and the balance within forty years.

During 1919 the proportion of African negroes among the immigrants was seven times as large as that of Mexicans and eighteen times as large as in 1913.

The proportion of immigrants from South Europe has decreased and that from Great Britain and France has increased about four times.

During the week ending October 31, 26,832 immigrants arrived in New York.

The authorities at Ellis Island have received numerous letters from different parts of the United States inviting immigrants to come there at wages as high in some cases as \$8 per day, which were offered for a hundred coal miners at Valesai, Ohio.

LABOR NOTES

The Bureau of Labor Statistics, United States Department of Labor, reports that on August 31, the prevailing rate of hourly pay for union carpenters varied from \$.75 in Memphis, Reading and Savannah to \$1.25 in Cleveland, Pittsburgh, and St. Louis. For cement finishers from \$.75 in

Memphis, Reading and St. Joseph to \$1.25 in Cleveland and St. Louis. For electricians \$.75 in Louisville to \$1.25 in Chicago, Omaha, Philadelphia and St. Louis. For hod carriers from \$.40 in Atlanta to \$1.10 in Philadelphia. For laborers \$.40 in Atlanta and Louisville to \$1 in Chicago and Detroit. For lathers \$.30 in St. Joseph to \$1.25. For painters \$.75 in Louisville, Reading and Atlanta to \$1.25 in Chicago and St. Louis. Plasterers from \$1 in six cities to \$1.37½ in St. Louis. For plasterers' tenders from \$.45 in Erie to \$1.25 in Detroit. For bricklayers from \$1 in Buffalo to \$1.50 in Pittsburgh. For elevator constructors from \$.70 in Erie to \$1.75 in four cities. For gas-fitters from \$.70 in Grand Rapids to \$1.25 in five cities. For hoisting engineers from \$.60 in St. Joseph to \$75 per week in Detroit. For marble cutters from \$.65 in Indianapolis to \$1.30 in Philadelphia. Marble setters \$.81 in Grand Rapids to \$1.50 in Buffalo. Masons from \$.90 in Cincinnati to \$1.30 in Philadelphia. Plumbers from \$1 in ten cities to \$1.25 in six cities. Roofers from \$.40 in Memphis to \$1.20 in Chicago and Reading. Steam-fitters from \$1 in ten cities to \$1.25 in eight cities. Stone cutters from \$1 in fourteen cities to \$1.25 in four cities. Structural iron workers from \$.65 in Grand Rapids to \$1.25 in eleven cities. Tile setters from \$.90 in Grand Rapids to \$1.35 in Buffalo.

In the last of October cuts of 15 to 20 per cent in the pay of the employees of textile mills in several places in New England were announced and it was stated that the Fall River mills were running at only 40 per cent capacity. It is expected that there will be a general wage reduction through the entire textile industry in New England. This will probably result in considerable unemployment and should increase the supply of labor and mechanics for other pursuits.

Report on Strikes

The Bureau of Statistics of the United States Department of Labor published a record of the strikes reported for the first six months of 1919 and 1920 which are, respectively, 1,544 and 1,813, thus showing an increase of 17 per cent over last year. These figures, however, include the number of lockouts reported which are comparatively insignificant, amounting to only 4.6 per cent for 1919 and reduced to 2.5 per cent for 1920. During the months of April, May and June there were 181 strikes and lockouts in Massachusetts and 179 in New York, 82 in Illinois, 75 in Ohio, 72 in Connecticut and 71 in Pennsylvania, 53 in Rhode Island and 40 in New Jersey; fourteen other states had from 10 to 25 in each, and twenty-three states and territories together had 120.

In New York there were 76, in Chicago 43 and in Boston 19. The total of 1,166 strikes and lockouts for April, May and June included 228 for the building trades, 100 for the metal trades, 112 for the railroad employees, 69 for freight handling and teaming, 25 for miners, 24 for street railways, 18 for stone workers, 13 for shipbuild-

ing, 16 for light, heat and power, 15 for street and sewer employees.

An average of 985 employees were concerned in each of 587 strikes.

Five hundred ninety-three strikes were for increase in wages, 38 for decreased hours, 97 for increase of wages and decrease of hours, 70 for recognition of union, 37 for recognition and wages, and 42 were sympathetic strikes. Eighty-one were reported as resulting in favor of employers and 67 in favor of employees, while 105 were compromised. The total number of days lost during the quarter was 5,297, which, estimating an average of only 500 each, would result in a total of more than two and one-half million days lost in three months.

The strikes involving the largest number of employees were those of the timber workers in the West and Northwest, 60,000; Kansas miners, 40,000; New Bedford mill hands, 20,000; Philadelphia carpenters, 10,000; Central New York building trades, 13,000; Cincinnati machinists, 10,000.

Labor Unions May Be Held Responsible

Two very important suits for damages against the United Mine Workers of America for heavy damages on account of rioting, bloodshed and property destruction by these unions in opposition to the open shop policy of the Coronado Coal Company of Arkansas and a similar case in Pennsylvania have been in litigation in the lower Federal courts for six years and have resulted in verdicts of conspiracy and penalties and costs aggregating more than \$1,000,000. They have been appealed and re-appealed, and at last they have reached the Supreme Court of the United States, and the last appeal by the United Mine Workers involving the deposit of more than \$1,000,000 of the union funds to guarantee payment of the judgments if the unions lose the case. If the judgment is finally upheld, all the members of a union may hereafter be held accountable if it can be shown that a conspiracy had existed in restraint of trade, contrary to the Sherman Act.

The affirmation of the judgment will go far to show justice for all and reasonable protection to the public and to employers and will strongly discourage future strikes and interference with business.

Criticisms of Government Contracts and Specifications Invited

During the month of June the construction department of the United States Army requested bids for seventeen large projects, all for more than \$100,000, with a total cost of over \$8,000,000. The fact that only sixty-two proposals, made by not more than fifty general contractors, were received was interpreted to indicate dissatisfaction with the circumstances surrounding the work in consequence of which L. L. Calvert, lieutenant-colonel, Q. M. Corps, has written an open letter to General Marshall, manager of the Associated General Contractors of America, in which he

states that it would be to the mutual advantage of the contractors and the government to determine what are the objectionable features of this work so that they may, if possible, be eliminated and larger competition secured. He requests the members of the association to criticize the government methods of inviting proposals, of writing specifications, of awarding and drawing up contracts and of handling the work in the field.

The association has published the letter in a bulletin and urges the expression of views based on information from original sources. He suggests the separation of criticisms on administrative powers, from those on contracts and specifications, the latter being more promising for points of attacks that may afford opportunity for action.

High Explosives Available for Blasting

Frank Page, chairman State Highway Commission, Raleigh, N. C., offers for sale at a moderate price a large quantity of "Modified T. N. T." that has been received from the Federal government and is suitable for ordinary blasting operations. It is put up in 100 1-pound cartridges to the case, can be handled with no more risk than ordinary dynamite, and has been found far superior to 40 per cent dynamite for removing rocks and stones. It is exploded by ordinary detonators and is offered for road work in lots of 1 ton or more at 22 cents per pound, and in smaller quantities at 25 cents per pound, f. o. b. cars Raleigh.

Increasing Volume of Railroad Transportation

The highest recorded volume of freight traffic ever transported in the history of the Pennsylvania Railroad System was handled during the month of October. Reports from all divisions show that during the month an average of nearly 24,000 loaded cars per day were forwarded to their respective destinations. This represents over 6,000,000 tons a week loaded on the Pennsylvania Railroad or accepted by it from connecting lines.

Proposed \$100,000,000 Waterfront Improvement

The Board of Estimate and Apportionment of New York City has received a proposition for the construction of \$100,000,000 improvement of 950 acres of unimproved swamp and meadow land belonging to the city on the shore of Jamaica bay. If the proposition is accepted it is intended to expend \$14,000,000 in the immediate construction of 5,000 feet of bulkhead, six 1,000-foot piers, and in dredging, filling and the building of necessary warehouses, streets and industrial plants that will be continued until the completion of the entire development, possibly within ten years.

The land is at present unoccupied and useless and was acquired by the city in 1910 without cash investment. According to this plan an annual rental of \$25,000 is offered to the city and the reversion at the end of a fifty-year lease of the

entire tract, which, it is estimated, will then, with its improvements, have a value of \$125,000,000.

This offer has been made by A. H. Greeley of Cleveland, president of the American Chain of Warehouses operating warehouses in more than 100 cities throughout the country. The proposition has been referred to a special subcommittee consisting of the president of the Board of Aldermen from the borough of Brooklyn and Queens, the deputy dock commissioner, Congressman William B. Cleary and Charles G. Bond.

Municipal Ownership in Newark

On November 2, the voters of Newark, N. J., approved a proposition for municipally owned gas, heating and power plants, it being reported that there was a majority of nearly 5,000 out of 65,000 votes on the subject. Local papers express the belief that this vote was caused largely by the poor quality of gas which is being supplied by the Public Service Gas Co., a corporation which supplies both gas and electricity to a large part of the northern section of New Jersey. There would seem to be no question that a provokingly poor quality of gas has been furnished to the score or more of communities served by this company since the State Public Service Commission gave it permission to lower the quality of gas and at the same time increase its rates very materially. As one of the local papers remarks editorially: "It is not likely that the populations of American cities generally favor municipal ownership propositions except as a measure of last resort. When private corporations fail to give good service or service at a reasonable cost, then the people turn toward municipal ownership."

Ditching With Dynamite

About $\frac{3}{4}$ of a mile of drainage ditches in the New Hanover Co. drainage district of North Carolina is being excavated by blasting with 2,000 pounds of dynamite. The work started on November 4, under the supervision of George R. Boyd, senior drainage engineer of the United States Department of Agriculture. The public, and especially the farmers of the district, have been invited to witness these operations in order that they may learn how to use dynamite in ditch excavation with a view to their adopting it for their private farm drainage ditches.

Favor Federal Department of Public Works

Hundreds of business organizations throughout the nation voted in a referendum on the Jones and Reavis bill for the establishment of a department of public works. Votes were received from 45 states, the District of Columbia, Hawaii and the Philippines. Of the total votes cast, 827½ favored the establishment of a Federal Public Works Department, with 549½ votes against it.

The vote also favored the formation of the department by the reorganization of the Department of the Interior, the idea being to change the name of this department, and to exclude from it all non-related bureaus and offices.

Missouri's Road Bond Issue

Missouri voters have approved an amendment under which Missouri hopes to begin constructing a real road system next season. The bonds to be issued for constructing the roads will be paid for, both principal and interest, by licenses for automobiles, it being apparently certain that such licenses will be more than sufficient for this purpose. There have been issued this year more than 292,000 automobile licenses in the state and the license fees have totaled more than \$2,000,000. Of the total number of licenses, the city of St. Louis has taken out less than 18 per cent, showing that the country districts are even more interested in good roads than the large cities.

New Jersey Highway Commission

The new State Highway Commission of New Jersey is endeavoring to improve and enlarge the provisions for maintaining the highways under its control and in connection with this is about to install five weighing scales in different parts of the state to assist in keeping truck loads within the legal limits. The State Highway Engineer, Thomas J. Wasser, advised the board that in order to keep the snow removed from the highways this winter it would be necessary to purchase 55 snow plows in addition to the 22 already owned by the highway department, and the commission authorized the engineer to advertise for such plows. At the same meeting, on October 27, the commission adopted its construction plan for the year 1921, including about 32 miles of highway and 14 bridges, in addition, of course, to the regular necessary maintenance.

The New Jersey State Highway Commission has approved the 1921 program calling for about four and one-half million dollars' worth of road construction, including one and one-half million dollars for the Amboy bridge.

Philadelphia Municipal Asphalt Plant

What is reported to be the largest municipal asphalt repair plant in the country is now nearing completion in Philadelphia. The daily capacity is given as 3,700 square yards. The final shipment of the material for the plant reached Philadelphia on November 6, this being two mechanical mixing units, received from the Iroquois plant of the Barber Asphalt Paving Co.

While the plant is rated at a capacity of 3,700 square yards, it is estimated that 4,000 square yards of completed pavement can be turned out in a day. The plant is to be used for patching work only and not for new construction.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Protecting Concrete From Frost III*

Enclosing the forms and heating the enclosed air.

Concrete forms should always be entirely free of snow, dirt and rubbish when the concrete is placed in them, and on this account the bottoms of tall forms, as those for columns, piers and very large girders, should be accessible and are often provided with small doors or hand-holes through which rubbish can be removed just before the concrete is placed. Forms should never be allowed to fill with snow, and if ice forms in them it should be removed completely and the forms warmed, which is most easily done with a jet of live steam just before the concrete is placed. In very cold weather dry forms also should be warmed by live steam, especially if they are made of steel.

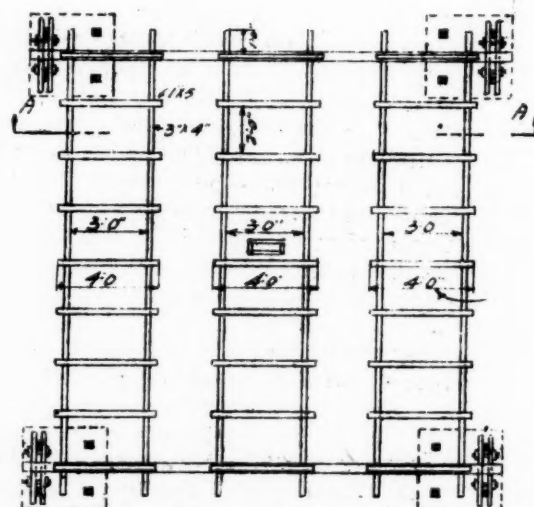
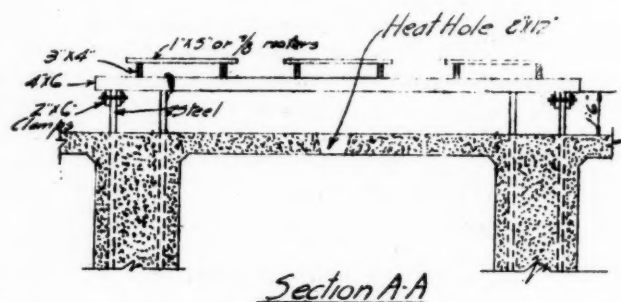
Very large forms may be warmed by salamander fires in or near them, and smaller forms, like those for columns and struts, may sometimes be warmed by placing a torch or large lamp in the lower part, in which case the top should be covered to prevent the escape of the warmed air.

Exposed constructions like arches, piers, columns and new buildings should be wholly or partly enclosed in cold weather so as to protect the concrete for several days after it is placed.

Tarpaulins or large sheets of heavy canvas with short, strong cords attached at frequent intervals on all the edges, are convenient, efficient, economical and most generally used as curtains, walls and roofs for protecting the exteriors of large concrete structures. Any required area can be covered by them if there are a sufficient number of pieces to be added successively, wide overlaps being always made between two successive pieces so as to prevent the escape of warm air

at the joints. The tarpaulins, singly or in multiple, can be easily stretched across the tops of open forms and fastened to their sides to protect roof and floor slabs, large piers, columns and girders.

Tall structures like smoke stacks, towers, standpipes and other reinforced concrete units that are concreted in upwardly sliding forms, are usually provided with a movable scaffold and hoisting apparatus that travels up on the forms and affords an excellent support for the canvas covering the top of the concrete as well as for the canvas curtains that overlap the top cover and are firmly secured to it and to each other, and are well tied at the bottom and if necessary at intermediate points, to resist wind and storms and to prevent any air spaces from being opened.



WOODEN FRAMEWORK, SECURED TO PROJECTING VERTICAL REINFORCEMENT BARS, TO SUPPORT CANVAS COVER

*Part I, Effect of frost on concrete, placing and protecting mass concrete, concrete in excavation and concrete pavements, was published Nov. 13. Part II, Heating, mixing water and aggregate and anti-freezing solutions, was published Nov. 20.

Spaces should be left between the curtains and the outer faces of the vertical walls to provide for air circulation, and the air on both sides of the walls should be kept hot for several days after the concrete has been placed. If it is a hollow structure with windows, doors or other openings in the exterior walls, it will suffice to heat the air in the interior and permit it to circulate through the holes, but if the walls are solid it is necessary to leave temporary holes in them a foot or two square, through which the air may pass and which are afterwards filled with concrete held securely in position by the tapered sides of the hole which is made smaller on one side than on the other for this purpose, and by reinforcement rods built into the original concrete and crossing the openings. If openings are not provided in the walls, it will be necessary to heat exterior and interior air by separate methods.

When concrete buildings are erected in cold weather it is often sufficient to enclose the outer wall of the last story concreted with canvas curtains and place canvas over the top of the last floor concreted, allowing them to remain in position several days while the air within is kept at a temperature of 60 to 80 degrees until the concrete is set and well hardened.

If the weather is very cold it will be necessary to enclose the last story concreted and the one next below it with curtains and to maintain heating apparatus in both stories, the curtains and the heaters being moved upwards as each successive story is added. To admit hot air to the upper side of the floor slab, temporary 8 x 12-inch circulation holes should be provided through it, one for every 300 feet of floor area. The holes should be somewhat smaller at the bottom than at the top so that when filled with concrete it will thoroughly key itself in position.

The canvas over the top of the structure is generally supported on a light wooden framework made with strips of standard lengths. The top of the framework should be not less than 6 inches and not more than 18 inches above the top of the concrete, thus giving space for air circulation and not requiring too large a volume of air to be heated. The rack or lagging that is placed on top of the framework to support the canvas may be light 1-inch strips 3 or 4 feet long and about 2 feet apart arranged, as indicated in the diagram in panels or sets also about 2 feet apart, thus preventing sagging of the canvas and economizing the support. The lagging is carried on longitudinal and transverse pieces that may rest on the form, or be blocked up from it, or, as is frequently convenient, be supported by clamps bolted to the projecting vertical reinforcement rods imbedded in the wall or column concrete. The details of such an arrangement designed for the protection of a reinforced concrete building, are shown in the accompanying diagram.

HEATING THE ENCLOSED AIR

The air enclosed in the temporary protection for the concrete construction can be maintained at a temperature of 60 to 80 degrees Fahrenheit even in zero weather and colder by the use of

stoves or open fires of various kinds in the structures or by steam. If the latter is used it should be supplied to some kind of radiator system or circulated through a sufficient length of closed pipe, although it can, of course, be sprayed through the perforations in the pipes into the enclosed atmosphere, thus gaining the advantage of additional moisture there at the expense of a much larger quantity of steam used.

For a large-size operation, such, for instance, as the placing of 500 cubic yards or more of concrete daily, a 50 h. p. boiler maintaining steam at 50 to 60 pounds pressure will be required to heat the air. For smaller operations a 20 to 25 h. p. boiler will suffice, often with a pressure of only 30 or 40 pounds.

From the main steam pipe a 1½-inch branch should be run to within 2 inches of the bottom of the water barrel for the mixer supply. Another 1½-inch branch should be run to coils of 1½-inch pipe under the sand, and a similar one under the stone or gravel pile. The pipes in these coils should be perforated on the under side, or, in case of difficulty through the holes becoming stopped, may advantageously be slotted with a hack saw cutting ⅛ way through the pipe at intervals of 12 to 18 inches.

Another 1½-inch line should be run to the structure and provided with outlets sufficient to command all parts of it and provide steam for the steam coils if such are used, and for melting ice and snow and warming the air in the forms. With low-pressure steam, sections of ordinary garden hose may be attached to these outlets for work on the forms and will be much more convenient and economical and flexible than steam hose or steel pipe.

It is recommended by an experienced contractor that a sufficient amount and pressure of steam should be provided to maintain the aggregate at a temperature of from 35 to 50 degrees when delivered to the concrete mixer, the mixing water at a temperature of 100 to 150 degrees and the concrete itself at a temperature of 60 to 70 degrees when discharged from the mixer, and never at a temperature of less than 50 degrees Fahrenheit.

In order to be sure that the heating is properly attended to, temperature records should be kept



CANVAS PROTECTION FOR UPPER STORIES OF CONCRETE BUILDING—SAND AND GRAVEL PILES IN FOREGROUND HEATED BY STEAM COIL UNDERNEATH

and readings recorded every 4 to 6 hours by thermometers located outside and at several different parts of the work and at different elevations, and the inside thermometers should show a temperature of 60 to 80 degrees under all conditions.

The air surrounding the concrete forms inside the protection may be heated by salamanders instead of steam pipes. These are vertical steel cylinders about 2 feet in diameter and 2 feet high, open at the top and with a grate at the bottom on which coke is burned to heat a large quantity of air in a very simple manner. They should be placed at the rate of about one salamander for every 3,000 cubic feet of air to be heated and should be carefully attended with a small quantity of fuel provided at frequent intervals to secure the greatest economy and efficiency. Care should also be taken to avoid danger of fire from the salamander, and barrels filled with water and fire buckets should be kept ready for immediate service if necessary.

REMOVING PROTECTION AND FORMS

The instructions issued by an experienced firm of contractors to govern the building of large reinforced concrete buildings in cold weather provide that the canvas covering the roof or floor slabs must not be removed until after the concrete is 48 hours old. The sides or walls of the canvas must not be removed until after the concrete is 96 hours old.

If the construction is of the flat slab type, the top canvas must not be removed until after the concrete is 72 hours old, nor the side canvas until it is 120 hours old. The girder forms must not be stripped until the concrete is 122 hours old.

In the construction of a 62 x 63-foot reinforced concrete building for the Erie City Iron Works, steam for heating the aggregate, thawing the forms, and warming the air around them was provided by an 18 h. p. boiler installed close to the mixer and hoisting tower and directly in the rear of the stone and sand piles shown in the accompanying photograph. The aggregates were stored over a gridiron of over 200 linear feet of 1½-inch steam pipe and were covered securely by tarpaulins at night when they were not disturbed by delivery to the mixer. The weather was so cold that it was necessary to enclose the two upper stories of the building with canvas curtains arranged and secured as shown in the picture. With these precautions, the work was carried on in very cold weather and was satisfactorily accomplished at a cost probably not more than 5 or 6 per cent greater than it would have been if the work had been done in warm weather.

George E. Datesman, C.E.

George E. Datesman, civil engineer, who died at his residence in Germantown, Pa., October 18, had been, prior to his resignation last January, for thirty years in the service of the city of Philadelphia, being made Director of Public Works in 1915. He was a graduate of Lafayette College, class of 1883, and first entered the city's service in 1885 as draftsman, afterward withdraw-

ing for a short time for private practice. In 1893 he became principal assistant engineer of the Bureau of Surveys in charge of a large amount of sewer designs, steel piers, dredging and in consultation on subway construction and the elimination of grade crossings. In 1913 he was commissioned to represent Philadelphia at the International Building Trade and Scientific Accessories Exposition at Leipzig, Germany, and to investigate Public Works in European cities. He was also consulting engineer for sewage disposal for the metropolitan sewage commission in New York City.

Charles N. Chadwick

Charles N. Chadwick, commissioner of the Board of Water Supply in the city of New York and chairman of the Brooklyn Committee of Bridges and Tunnels, died at his home in Lyme, Conn., October 23, at the age of 73 years. As a member of the Board of Water Supply he was prominently identified with general administration and legal matters pertaining to the construction of the Catskill aqueduct.

Edwin Thatcher, C.E.

Edwin Thatcher, an eminent bridge engineer, died at his residence in New York City September 21. After graduation from the Rensselaer Polytechnic Institute of Troy in the Class of 1863 he became assistant engineer of a railroad in Iowa and afterwards became one of the pioneer builders of iron and steel highway bridges. Associated with Mr. Keepers he for many years conducted the Milwaukee bridge shops, constructing a large amount of work in the West and in the Mississippi valley. Later he was associated for some time with a bridge company in Alabama.

For several years he was chief engineer of the Keystone Bridge Company, Pittsburgh, at that time one of the foremost shops in the country and famous for its construction of the notable Eads bridge across the Mississippi at St. Louis. After leaving the Keystone Bridge Company, Mr. Thatcher personally supervised the construction of concrete bridge work in Cuba and in 1901, in partnership with William Meuser, founded the Concrete Steel Engineering Company of New York, prominent in the promotion of reinforced concrete arch construction.

Mr. Thatcher was a man of high abilities, an able mathematician and an excellent designer. Many years ago he perfected and put on the market the famous Thatcher slide rule, which is of great value for facilitating estimates and computations and for many years was the leading instrument of the kind used in this country. In recent years Mr. Thatcher was engaged principally in consulting practice. He was an able engineer and of an attractive, companionable character that made him hosts of friends. He was one of the last of the old-school engineers prominent in the American Society of Civil Engineers twenty or thirty years ago.

Recent Legal Decisions

COMPETITIVE BIDDING AFFECTED BY TERMS OF BOND

A council passed an ordinance authorizing certain sewer work provided the bidder should give a bond in a sum equal to the contract price "to be forfeited if he failed to complete the work within 90 working days from the execution of the contract." The bond furnished, however, provided that it should not be forfeited, but that only \$4 per day should be paid for each working day that the work was not completed after 90 days. This would have been a material consideration to bidders on the contract, and one that might reasonably have affected, favorably to the property owner, the bids of all the competitors. For this reason it was held, *Ford v. Excelsior Spring Land & Waters Co.*, (Mo.) 223 S. W. 960, that there was no competitive bidding and therefore the tax bills for the work were void.

SEWER COMMISSIONER'S DECISION MADE FINAL BY CONTRACT

The Missouri Supreme Court holds, *Universal Const. Co. v. City of St. Louis*, 223 S. W. 931, that where a city and a contractor agreed that "the sewer commissioner shall in all cases determine the amount or quantity or the classification of the several kinds of work or material which are to be paid for under this agreement, and that he shall decide all questions which may arise relative to the execution of this agreement, and his estimates and decisions shall be final and conclusive," the contract is the law as between the parties and the commissioner is the judge. No appeal lies from his decision in the absence of fraud, mistake, or such gross negligence or arbitrariness as would be tantamount to fraud.

CASH AT CREDIT OF SPECIAL FUND FOR PUBLIC UTILITY DEDUCTED IN FIXING LIMIT OF INDEBTEDNESS

The Alabama Supreme Court holds, *Town of Camden v. Fairbanks, Morse & Co.*, 86 So. 8, that if assets of a city in bonds and money in a sinking fund devoted by law to the payment of specific debts are to be deducted from the total amount of outstanding bonds of that city, for the purpose of determining its actual indebtedness under constitutional provision and limitations, for like reasons cash on hand to the credit of a special fund for a public municipal utility provided by the Constitution must likewise be deducted, in ascertaining a city's indebtedness under constitutional limitation to contract debts in the purchase or construction of such special utility, represented by said special fund in the treasury. In such case it will be presumed that the bonds or cash will be applied to the purpose for which by law it must be devoted.

ORDINANCE PASSED WITHOUT HEARING ON REMONSTRANCES INVALID UNDER NEW JERSEY HOME RULE ACT

The New Jersey "Home Rule Act" of 1917 provides for the filing of a remonstrance by property owners affected by a proposed local public improvement. Such a remonstrance was filed, but was not

acted upon by city commissioners, and no hearing was accorded the remonstrants, but an ordinance providing for the construction of sidewalks and curbs upon certain streets was passed without reference to the remonstrances. The New Jersey Court of Errors and Appeals holds, *Logan v. Belsferd*, 111 Atl. 3. (1) That the ordinance passed under such circumstances was invalid. (2) That the hearing accorded by the statute in such cases was a condition precedent to the valid exercise of the statutory power to pass the ordinance.

REGULATION OF FREE SERVICE OF WATER TO CITIES

The Oregon Supreme Court has denied a rehearing in the case of *City of Hillsboro v. Public Service Commission*, 187 Pac. 617, 192 Pac. 390, in which it was held that a franchise contract between a city and a water company, whereby the company agreed to install as many fire hydrants as should be ordered by the city, for which the city agreed to pay \$1 a month each for five years, after which the company was to maintain and install hydrants without cost to the city, was a rate making contract made by the city not exclusively in its proprietary capacity, so that the Public Service Commission could order the company on its petition to discontinue free hydrants and charge the city \$3.50 a month for each hydrant without violating article 1, par. 10, of the United States Constitution prohibiting impairment of the obligations of contracts. The court holds that the provision of section 63 of the Public Service Commission Act that it shall not prevent service to cities free or at reduced rates, does not require free service to cities by public utilities, or deprive the commission of power to control such service; and that the commission can regulate rates charged by a water company supplying water to a city having a home rule charter.

ASSIGNMENT BY CONTRACTOR ON PUBLIC WORKS OF MONEY DUE MUST BE FILED UNDER NEW YORK STATUTE

Before the enactment of the statutes now embodied in sections 15 and 16 of the New York Lien Law, an assignment of moneys due on a building contract took precedence over the statutory liens of those furnishing labor and material. This situation was a hardship to this class, and these sections each provide, the latter in relation to contracts for public improvements and the other for other improvements that no assignment of a contract, or of money, or of part thereof, due or to become due, shall be valid until such assignment be filed in certain specified offices. These sections, it is held, *Merchants' Nat. Bank v. Long*, 184 N. Y. Supp. 34, were enacted for the protection of a definite class, namely, laborers and materialmen, and cannot be taken advantage of by a judgment or attaching creditor, or by one advancing money to the contractor, where it is not shown that such money was used by the contractor in the prosecution of the work.

NEWS OF THE SOCIETIES

Nov. 30—NATIONAL CONFERENCE OF HEALTH OFFICERS. Dr. Henry F. Vaughan, Detroit, Mich.

Nov. 30-Dec. 2—UNION OF MANITOBA MUNICIPALITIES. Annual convention at Brandon, Man. Secretary, Robert Forks, Pipestone, Manitoba, Canada.

Dec. 6-9—INDUSTRIAL SAFETY CONGRESS. State Industrial Commission. Syracuse, N. Y.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, New York. Secretary, 29 W. 39th St., New York City.

Dec. 8-10—NATIONAL RIVERS & HARBORS CONGRESS. Annual convention. Washington, D. C.

Dec. 9—THE BROOKLYN ENGINEERS' CLUB. Annual Meeting, election of officers.

Dec. 13-16—AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. Annual convention. Washington, D. C.

Dec. 16-17—THE KANSAS ENGINEERING SOCIETY. Annual meeting. Topeka, Kansas.

Jan. 19—AMERICAN SOCIETY CIVIL ENGINEERS. New York City.

Jan. 19—INTERNATIONAL CUT STONE CONTRACTORS' AND QUARRYMEN'S ASSOCIATION, Inc. Annual meeting. Congress Hotel, Chicago, Ill.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

Jan. 25-27—ASSOCIATED GENERAL CONTRACTORS OF AMERICA. Annual convention. Washington, D. C.; New Orleans.

Feb. 7—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual convention. Coliseum, Chicago. E. L. Powers, 11 Waverly Place, New York City.

May 17-19, 1921—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention Fort Wayne, Ind.

June 7-9, 1921—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. San Francisco, Cal.

June, 1921—CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS. State of N. Y. 12th Annual Conference. Elmira, N. Y.

OKLAHOMA HIGHWAY ENGINEERS

The temporary legislative committee of the Oklahoma Highway engineers has recommended and the highway engineers have adopted the following proposed legislation:

The county engineer shall be appointed by the board of county commissioners. He shall have charge of and be superintendent of all maintenance and construction on the public highways of the county, and of one county only. The minimum salary to be paid in counties with a valuation of ten million dollars or less shall be \$2,100 per annum. Where the valuation is from ten to twenty million the salary shall be a minimum of \$3,000 per annum; twenty to thirty million, \$3,600 per annum; thirty to fifty million, \$4,200 per annum; fifty million or over, \$4,800 per annum.

The law governing the destruction of roads to be made more clear and more stringent. The load per bearing inch and maximum of any wheel to be limited.

All construction work to be performed under the direction of the county engineer to be approved by the state highway department before construction is authorized by the county commissioner.

Salaries of the commissioner of highways, the state engineer and his assistants to be increased to compare with the salaries paid by engineers of other road building states.

NATIONAL MUNICIPAL LEAGUE

Some of the important subjects discussed at the twenty-sixth annual meeting of this society, held in Indianapolis, Ind., November 17-19, were: "Service at Cost for Street Railways, Panacea or Nostrum"; "How the City Manager Plan Works—the Latest Evidence"; "Methods Whereby Civic Organizations Influence Elections"; "Government Aids to Housing."

The Hon. Charles E. Hughes, president of the league, in his presidential address spoke on "The Fate of the Direct Primary."

AMERICAN ASSOCIATION OF ENGINEERS

The following appointments have been made to the New York State Board of Licensing for professional engineers and land surveyors: W. J. Wilgus, 165 Broadway, New York City, appointed for a term of five years; Percy A. Barbour, 29 West 39th street, New York City, appointed for a term of four years; H. G. Reist, General Electric Company, Schenectady, N. Y., appointed for a term of three years; Victor M. Palmer, Eastman Kodak Company, Rochester, N. Y., appointed for a term of two years; E. H. Hooker, Electro-Chemical Company, Niagara Falls, N. Y., appointed for a term of one year.

The New York Chapter of the American Association of Engineers, has voted to contribute a sum not to exceed \$100 toward the promotion of the bill providing for a national department of public works.

Under the new regulations just issued railroad professional engineers are designated as "technical engineers." This class shall include civil, mechanical, electrical and other technical engineers inferior in rank to engineers of maintenance of way, chief engineers and division engineers, engineers of maintenance of way and other technical engineers. We are of the opinion that instrument men, rodmen, chainmen, designers, draftsmen, computers, tracers, chemists and others engaged in similar engineering or technical work are not "officials of carriers."

A committee to bring in twelve activities listed in order of importance as desirable lines of activity for the association, was appointed November 10, consisting of Mr. Hodges, J. W. Moore and Mr. Daniels. They will probably ask for suggestions from members at the next meeting.

DENVER MEETING OF THE LEAGUE OF THE SOUTH-WEST

At this meeting Director A. P. Davis of the U. S. Reclamation Service told the delegates of his investigations in the Colorado river basin. He said "that the controlling factor on the

lower river was the Boulder Canon dam—400 feet or more in height—which would control the floods and furnish power and irrigation for the Imperial valley and other units to be irrigated in the United States and Mexico."

Fred L. Lucas, constructing engineer of Colorado, outlined the plans of the Western States Reclamation Service, composed of thirteen states and announced that a campaign for an appropriation of 250 million dollars for the completion of the various uncompleted reclamation projects was in progress.

FORM NEW ASSOCIATION OF MUNICIPAL CONTRACTORS

At a special meeting held by the paving and sewer contractors of Toronto during the week of October 21 in the Toronto Builders' Exchange, plans were made to form an association consisting of sewer, sidewalk and paving contractors of that city and vicinity and to apply to the Builders' Exchange for permission to operate as a branch of that organization.

A. W. Godson, of the Godson Contracting Co., Ltd., was elected chairman of the new association, and L. C. Reynolds, business manager of the Toronto Builders' Exchange, was elected secretary.

FEDERATED AMERICAN ENGINEERING SOCIETIES

The Kansas Engineering Society has voted to become a charter member of the F. A. E. S. and has appointed Lloyd B. Smith as their delegate to represent the society at the first meeting of the Council. The Alabama Technical Council is also to become a charter member of the society.

The executive board of the Associated General Contractors will meet in the Old Colony Club Rooms at the Raleigh Hotel, Washington, on November 15, 10 a. m.

PERSONALS

Andrews, H. N., has accepted a position in the engineering department of the Wheeling Steel Corporation, Wheeling, W. Va.

Asbury, E. P., has been appointed engineer of Collins county, Texas.

Barrett, Alfred M., formerly superintendent of highways, Borough of Queens, has been appointed Public Service Commissioner for the First District, New York.

Bishop, Hubert K., chief engineer of the Indiana State Highway Department, has resigned.

Boyer, C. C., formerly with the California Highway Department, has been appointed district engineer of the Nevada Highway Department.

Cameron, Major H. F., Corps of Engineers, U. S. A., has been assigned to duty as assistant to the district engineer on the construction of the Wilson dam at Florence, Ala.

Chase, W. G., chief engineer of the Winnipeg aqueduct, has been appointed consulting engineer to the Saskatchewan Water Commission.

Cleveland, L. B., chief engineer and superintendent of the Auburn Water Board, has resigned.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

AUSTIN MODEL 5 EXCAVATOR

The Austin Machinery Co. catalog No. 6 illustrates and describes an excavating machine mounted on caterpillar traction, that with different boom and bucket fittings, can be used as a drag-line excavator, as a steam shovel, as a railroad ditcher, or with a clam-shell bucket or a skimmer bucket or as an ordinary locomotive crane or with a magnet hoist.

The principal features of construction include a turntable 5 feet in diameter, hoist drum 12 1/2 inches in diameter, boom suspension control operated by drum geared to main machinery, double cone, spiral control, spring release drum clutches, 12-inch friction disks type inside band, swing clutches and a four-cylinder gasoline type marine enclosed, heavy-duty engine with large fly wheels. The turntable and center are made in one piece and multipedal traction is made with special

pressed steel units with a combined area reducing the load on the ground to 5 1/4 pounds per square inch. The machine burns from 35 to 45 gallons of kerosene or distillate in ten hours and has traction speeds of 1/2 mile and of 1 1/4 miles per hour, drag-line or hoist line speed of 110 feet per minute, single hitch and swing speed of 3 1/2 r. p. m., giving it a capacity of 300 to 600 cubic yards in ten hours with a 3/4-yard bucket.

Used as a drag-line machine with a 1/2 or 3/4-yard bucket and 30-foot boom, the average working speed is 1 to 3 buckets per minute, and the shipping weight is 38,000 pounds. It is recommended for cleaning or enlarging old ditches or building levees, road grading and sewer excavations and for cutting trenches as small as 3-foot bottoms and 1:1 slopes.

Equipped as a steam shovel with a 6 1/2-foot boom and a 3/4-yard dipper it is economical for all kinds of steam shovel work and has a long handle dipper arm for the excavation of sewer trenches to a maximum depth of 14 feet. The rated capacity per hour for deep cuts is from 50 to 60 cubic yards and for shallow cuts from 25 to 35 cubic yards. The shipping weight is 35,500 pounds and the average working speed 1 to 3 dippers per minute.

When used as a railroad ditcher it is mounted on trucks with double flange rollers and can be used to advantage on a flat car or between two ballast cars. This equipment weighs 24,500 pounds and is suitable for use as a loading machine when the shovel and dipper arm are eliminated.

When equipped with a 30-foot trussed boom and a clam-shell bucket or an orange peel bucket it is efficiently operated by the two-drum control and is recommended for sewer work, gravel banks, dredging, excavating and general rehandling. It will handle coal, stone, gravel, or sand at the rate



SKIMMER BOOM AND BUCKET EXCAVATING MACHINE WITH CATERPILLER TRACTION, CONVERTIBLE FOR LOCOMOTIVE CRANE SERVICE

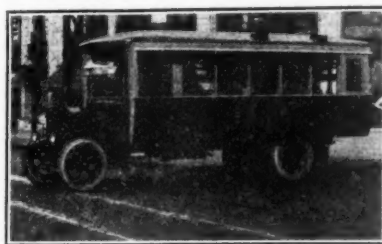
of 400 to 600 cubic yards daily, and weighs 32,500 pounds.

When equipped with a skimmer bucket it will make a cut from a few inches to a foot in depth and 12 to 14 feet in width, leaving a smooth surface at any desired grade or slope and will load sand, gravel, clay and boulders up to 24 inches in diameter. It will take up and load broken asphalt pavement or any material that can be broken with a plow. It will grade and load from curb to curb or a 40-foot street with a 20-foot skimmer boom and 3/4-yard bucket; the weight is 34,500 pounds.

The 30-foot boom can be equipped with hoisting rackle and bottom block or with a lifting magnet having a hoisting capacity of 4,500 pounds at 30-foot radius, 5,500 pounds at 35 feet, 6,750 at 20 feet and 13,000 pounds at 10 feet radius. It can be mounted either on the multipedal traction, on railroad tracks or on wide traction wheels, and serves excellently as a tractor to pull loaded wagons, trucks and cars.

PIERCE-ARROW MOTOR BUSES

The Pierce-Arrow Motor Car Company has developed a new type of motor bus which recently was put into



25-PASSENGER, ELECTRIC LIGHTED 23-MILE PER HOUR MOTOR BUS

active service in Buffalo by the company. This bus, mounted on a Pierce-Arrow two-ton dual valve chassis equipped with pneumatic tires, seats 25 persons comfortably.

This bus enables the electric railway to give service in newly opened sections without going to the expense of laying tracks. It can be used to relieve the heavy passenger traffic burden during rush hours by running on streets paralleling the trolley streets and thus permitting electric cars to make faster headway.

The steel body is fitted with all safety devices and modern conveniences, including electric lights, push buttons, a heating system and window screens and shades. The bus attains a speed of 23 miles an hour with ease, and handles well in traffic. Although commodious, the bus is of such efficient design that it does not give the impression of bulkiness. It conforms to state and city regulations.

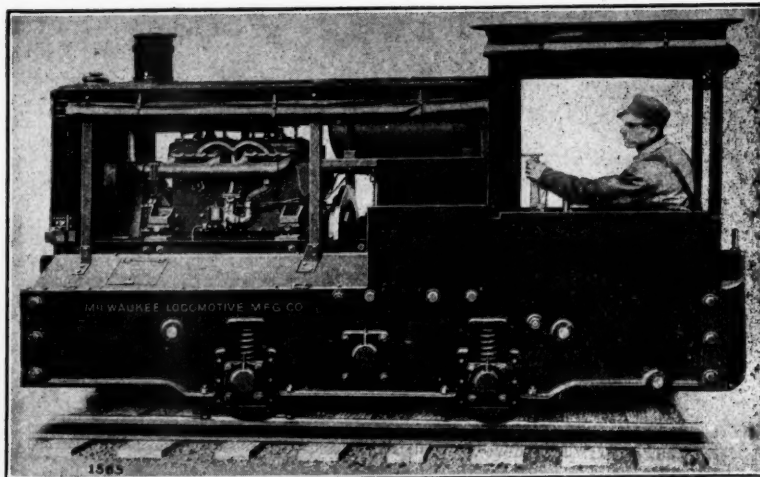
DAKE SWINGING ENGINES

The Dake swinger is a compound gear equipped with Dake reversing engine, making a combination of units powerful in proportion to weight. The operation is very simple, the engine being started, stopped and reversed by the same lever. It gives perfect control of the derrick boom and permits it to be swung at speed and gently stopped in the required position.

There are no reverse clutches and no dead-centers, therefore the engine always responds instantly to forward or reverse motion. The swinger has a low frame and drum that can be bolted directly in front of the main hoist with clearance for the lines, and can be operated from the hoist man's position. It is manufactured with and without the automatic brake, by the Dake Engine Company.

MILWAUKEE GASOLINE LOCOMOTIVES

These machines, made by the Milwaukee Manufacturing Company, are claimed by them to be more economical to install and operate than either electric or compressed air locomotives because they are independent concrete units of power and require no auxiliary power or plant, overhead wiring, bonding of rails, or extensive pipe lines. They are equipped with special four-cylinder, four-cycle, vertical type engine, with oil circulating pump of the geared type. The speeds are changed by means of jaw clutches with all gears in mesh, and the clutch cones of the driving and reversing mechanism may be easily and cheaply replaced. Transmission is of the friction type. For different services, several types are manufactured of $2\frac{1}{2}$ to 14 tons weight. They are made with one and two speeds forward and reverse and can be furnished with electric starting and lighting equipment.



6-TON LOCOMOTIVE WITH ELECTRIC STARTING AND LIGHTING EQUIPMENT

NEW YORK CITY BUYS 50 HOLT CATERPILLAR TRACTOIS

As the result of comparative tests made last summer with different kinds of motor vehicles plowing sand spread on asphalt streets to imitate snow, the Department of Street Cleaning, New York City, has ordered from the Holt Manufacturing Company 50 caterpillar 5-ton tractors, artillery model, for the heavy work of snow removal this winter.

These machines were ordered at a higher price than some of the competing machines because it was considered that they were especially fitted for this class of work and on account of the military and commercial records for past performances as well as for the "stability and facilities of the manufacturers."

The Holt Company states that "the caterpillar which had been the exclusive tractor choice of all the allied governments during the war, was responsible for the inception of the fighting tanks, and was adapted exclusively by the United States War Department after exhaustive tests, for motorization of field artillery and heavy ordnance

transportation." Since the war caterpillar tractors have been extensively used for different classes of commercial and industrial work, including the transportation of materials and machinery in roadless country and for road building and maintenance, heavy hauling, logging and many other classes of difficult work.

HELTZEL STEEL PAVEMENT FORMS USED FOR RECORD CONCRETE PAVEMENT

Heltzel steel forms were used for the highway concreted at record speed by McCrae, Moore & Co., near Big Lake, Minn., as described in PUBLIC WORKS, page 434, November 6.

The operations could not have been so rapid, continuous and satisfactory nor the construction so excellent with inferior forms that might involve delay or cause imperfections.

Other contractors, including Seims, Helmers & Schaffner, of St. Paul, and A. J. Parrish, of Paris, Ill., are reported to have made records concreting with Heltzel heavy-duty type, the standard rail, and Heltzel light road forms with narrow 2-inch top and bottom flanges.

THE H. H. ROBERTSON CO.

The H. H. Robertson Co., Pittsburgh, formerly the Asbestos Protected Metal Co., announces the appointment of Major Hillis F. Hackedorn, former district manager of the Detroit office, as district manager in charge of the following territory:

Ohio (part), Indiana, Arkansas (part), Michigan, Wisconsin, Illinois, Missouri, Iowa, Minnesota, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma (part), Ontario (Essex county).

Major Hackedorn will have his headquarters in Chicago and will have charge of all the company's offices and activities of the company's district managers, agents and sub-agents in the territory enumerated.

PERSONALS

Newcomer, Col. Henry C., has been appointed division engineer of the U. S. Engineering Department with headquarters in New Orleans.

Peters, J. F., has been appointed part-time secretary of the St. Louis Chapter of the American Association of Engineers, with an office at 320 Columbia Bldg., that city.

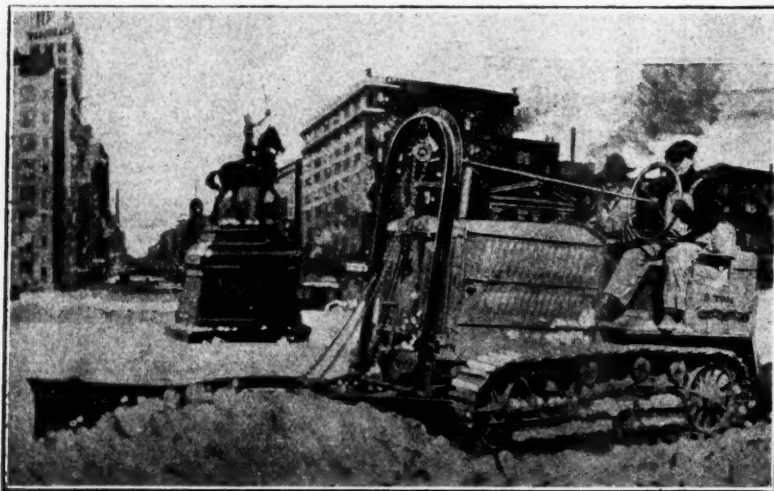
Rogers, Ira, has been appointed resident engineer on Federal Aid Project 60, Kansas Highway Commission, with headquarters at Garnett.

Sherman, Charles W., of Metcalf & Eddy, Boston, Mass., has been nominated for the presidency of the New England Water Works Association for 1921.

Saunders, W. L., connected with the Concrete Steel Co., New York, has been appointed district engineer of the Washington office.

Simon, Louis I., and Mr. Koenigsberg have opened an architectural and engineering office at 8 South Dearborn street, Chicago.

Thomas, C. C., formerly professor of mechanical engineering, Johns Hopkins University, Baltimore, Md., has opened a consulting engineering office in Los Angeles, Cal.



5-TON CATERPILLAR TRACTOR, MILITARY MODEL, OPERATING SNOW PLOW